A METHOD OF STUDYING EDISON DISTRIBUTION SYSTEMS—*Mechanical strength of soft and hard copper wire splices and other engineering articles.*

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Electrical World

New York, August 19, 1916 McGraw Publishing Co., Inc. Vol. 68, No. 8 10c a copy

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Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.
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Coal Supply Threatened by Railroad Strike

FEW central stations have sufficient coal in reserve to make it possible to operate without constant replenishment. Should the threatened railroad strike materialize, it will be impossible to meet the lighting and power requirements of inland communities depending on the railroads for their coal supply. Coal is the life-blood of power in the average community and the threatened tie-up will, of course, not only result in hardship to individual central stations but to the communities which they serve. It is in situations like this when the value of transmission networks is at once particularly apparent. Sources of power supply, especially if the network includes waterpower, can be pooled and all the reserves in reservoir or coal-bin capacity turned to the service of the communities which are included in such a network. Even such measures would, of course, meet the demand for a short time only. The threatened strike emphasizes once more the interlocking of services which knit together our industrial, commercial and social life, making one economically dependent on the other. A strike which shuts down the railroads seems far away; a strike which cuts off our coal supply is nearer; and a strike which means that we burn candles to-night, instead of turning on an electric switch, comes home as an individual matter. Combined individuals make public opinion and the public opinion formed under these conditions should make such a strike impossible.

Teaching the Teachers

A RECENT paper before the Associated Advertising Clubs at Philadelphia touched so closely the merchandising problems of the electrical industry that the point deserves to be especially emphasized when electrical manufacturers and the larger central stations are undertaking to reach the final user through the mediums that he reads, the general magazines and the newspapers. The speaker suggested that the man who is seeking the consumer should not overlook that intermediate group in any industry which stands between him and the final user. Concretely, the central station manager who advertises one policy in the newspapers and permits his employees to carry it out half-heartedly is largely wasting his money solely because they have not had the plan explained. His employees come in closer contact with his customers than the newspapers. If they tell the same story as the advertising, the chain is complete and the advertising in the papers and the advertising by employees supplement and strengthen each other. His own business is a normal school. He can reach out directly as the head of it and lecture the public "pupils," but how much easier it is to "teach the teachers" and have them explaining his policies in detail as they meet the customers.

Similarly the manufacturer who concludes to advertise to the final user of his product and neglects to tell distributors what he is doing and how this "consumer advertising" is part of a plan to increase their mutual profits, fails in his conception of advertising. Between the manufacturer and the final buyer of a product is the interwoven fabric of an industry, the engineer, the jobber, the dealer, the central station, all standing between the manufacturer and the final market for his goods.

Take the electric range as an example. Here is a product which may be advertised to the final user. True, it will cost money to do it right. It will take time to pick out popular magazines that reach enough prospective users on electric circuits to warrant paying the price per issue for that circulation plus a large proportion necessarily wasted. It will take time to work out advertising with a popular appeal, and it will cost something also for special work, booklets, follow-up letters, and so on. All this for the "pupils." What about the teacher. Here is the central station manager who is hesitating over the capital investment necessary in taking on a stock, the engineer figuring on rates and installation expense, the salesmen needing demonstrators. It is evidently necessary to educate them also, to answer these questions which they as the "teachers" are asking. That is the function of the in-between advertising, the kind that "teaches the teacher" as the merchandising man put it at the Philadelphia convention, and it should not be overlooked by the manufacturers and distributors of electrical goods and electrical service.

Mechanical Strength of Copper Wire Splices

AN interesting article in this issue by E. R. Shepard, deals with mechanical tests of copper wires, conducted at the Bureau of Standards. The results are valuable, as being confirmatory of the best already existing knowledge on the subject. They show that in the ordinary sizes of transmission wire, soft copper has a breaking strength of about 25, medium copper 35, and hard copper 45 kg. per square millimeter. Seeing then that hard drawn copper has nearly twice the strength of soft drawn copper, and that there is but little difference in price, or in electric conductivity, between the two, it would appear self-evident that hard copper is

the only material to be used. In theory, the soft wire has no chance by comparison. It must be remembered, however, that hard drawn copper is very awkward and troublesome material to handle in the field. Unless watched with great care, it is so unpliable that when pulled it is liable to kink, and a kink means a cut and a new splice, because it is almost impossible to take a sharp kink out of hard copper wire without breaking it. It is no wonder, therefore, that construction-gang foremen do not cherish affection for hard copper wire. Even to medium wire they are lukewarm.

Another well known objection to hard drawn or medium wire is that taps and splices are harder to make than in soft wire. Moreover, if solder is used, the temper is apt to be drawn from the hard wire in the soldering process, thus leaving treacherous weak places, that may unexpectedly break under stress at most unfortunate times.

Mr. Shepard's results indicate the very useful fact that if a splice or tap spiral is made with generous and ample length, the central parts only need be soldered, and the danger of annealing the wire is greatly reduced. It requires, however, more than the average training, skill and field discipline to carry out the proper technique of the laboratory in remote wild districts, when the orders are to push the construction with all speed, and the engineer in charge is perhaps at the other end of the line. The results also indicate that there is apparently no warrant for the very popular belief, that in hard wire the toughness is only skin deep. Modern hard wire is hard-hearted and tough throughout.

Radiation of Waves in Wireless Telegraphy

THE problem of learning, and to some extent visualizing what goes on in the neighborhood of a radiating aerial-wire system, as used in wireless telegraphy, has puzzled students of radio transmission for many years. In the usual explanations there is first considered an elemental charge which is supposed to surge up and down in the mast wire. This charge has lines of electrostatic stress passing from itself to its companion charge in the earth. By reason of its motion, the positions of the electrostatic lines change from instant to instant. Furthermore, the movement sets up electromagnetic whirls about the current paths, and the flow of electrons up and down the antenna is accompanied by radial flows of current in the earth's surface near to the base of the aerial. The motions are so rapid that the electrostatic lines are closed on themselves (or by grounding), and are repelled from the aerial as sliding half-loops which pass out over the face of the earth. At about this point in considering the matter, the investigator usually begins to confess that he has difficulty in carrying mentally the interactions of the electromagnetic and electrostatic forces and earth currents. And he may well be pardoned for giving up. The task of picturing the complete series of phonomena is truly beyond normal psychological limitations.

In the Digest for this week we give an abstract of Fritz Lowenstein's paper on "The Mechanism of Radiation and Propagation in Radio Communication," from a recent issue of the Proceedings of the Institute of Radio Engineers. The author is well known as a present-day worker in radio telegraphy, and was associated with much of Nikola Tesla's early experimental work on "high frequency" currents. Study of his paper brings out some interesting points of comparison and contrast between the simple electrostatic induction systems of telegraphy and the radiant half-wave methods. He prefers to look at modern radio telegraphy as a development of Tesla's early suggestions anent the transmission of power by earth-surges, and advances some arguments to support his view. This proposition is always worthy of study, though the inevitable result of examining it seems to be an agreement with Dr. Zenneck's statement that a current theory without electromagnetic waves is incomplete, as is an electromagnetic wave theory which does not consider earth currents.

Increased Illumination and Load Factors

CENTRAL STATION load factors have been increasing steadily the past ten years. Most of this increase is due to a greater diversity of load and an increase in the proportion of power business. It has perhaps not been sufficiently realized what an important part increased standards of illumination have had in the increase of load factors. Some central station men are inclined to look upon the lighting load factor in general, as being low, taken as a whole. Every increase in the general standard of artificial illumination, however, tends to increase this load factor. Such an increase in illumination standards has been going on steadily. Every improvement in lamp efficiency has generally resulted in an increase in the amount of illumination used, rather than a decrease in the kilowatt-hours consumed. It is proper that this should be so because, in many cases, old standards were too low for the best comfort and efficiency of the light user. Load factor increases with illumination because the greater the illumination the more hours per day the lamps are likely to be used. This is best made plain by a specific example. Take the case of an office in which, fifteen years ago, the occupants were satisfied with an artificial illumination giving about one foot-candle. When darkness came on in such an office, either at night, or during the day because of cloudy weather, the lamps would probably be turned on at a time when they would make a noticeable increase in the amount of illumination. This point would probably not be reached until the natural illumination had dropped to two or three foot-candles. The same office to-day, if its lighting equipment is thoroughly up-to-date and its managers are looking carefully after the comfort and efficiency of the employees, is likely to have from four to six foot-candles average illumination by artificial light. We will assume five foot-candles as the standard of comparison with the old condition. The artificial lighting will, as before, be turned on when the natural lighting has

dropped to a point where turning on the artificial lighting makes a noticeable increase in the illumination. Using the former ratio this would be approximately when the natural illumination fell to ten or fifteen foot-candles. In other words, therefore, when darkness comes on, artificial lighting is resorted to much earlier than under the old conditions and there will be numerous times during the day in some locations where the artificial lighting will be turned on, in these days, where it would not have been used at all fifteen years ago. Increasing appreciation of the value of ample and comfortable artificial lighting and consequent increase in illumination standards must, therefore, inevitably lead to increasing load factors for lighting business on central station systems.

Unsnarling a Network

THE distribution investigation described by C. E. Bennett in the current issue was certainly as intricate and exasperating as could be wished by the most implacable enemy of economy. The problem as it presented itself to him was nothing less than the analysis of the distribution potentials and losses in a direct-current, three-wire system which fate and haphazard development had mixed up to an almost inconceivable extent. The cables, to be sure, were more or less accessible but information on their size, route and destination was incomplete. After a full record of cables and services was finally at hand, the concrete problem was to determine the best use of the copper which had been at various periods and for various purposes stowed away under ground.

A prerequisite for either analytical or experimental study of this matter was an analysis of the load distribution. It was obtained from the services located and the records of the connected load of the customers combined with the load curves at the station and at various points on the system. Now it is possible eventually to compute the drops of potential and distribution of current in any kind of a network, but in the complications actually found the task was enough to stagger a human logarithm table, and we are inclined to think that Mr. Bennett took a very practical short cut by falling back on the construction of a miniature system from which the required data at the present or any future time could be obtained by rapid experimentation. In the early days of networks, before their theory had been well worked out, a miniature working system was occasionally found to be a very useful device. Distribution systems planned on strictly modern lines, however, are ordinarily simple enough to be computed with a fair degree of ease. In the case before us complication piled on complication until a recourse to first principles became a very useful procedure.

The first important discovery was that the feeders were too big and the mains too small for the best economy. Then the drops in some parts of the system were found to be excessive, from the standpoint of regulation, and in other parts too small for maximum economy of copper. All these pointed the way to the more judicious use of the cables which were at command so as to equalize and steady the voltage changes and to strike the best possible balance between loss of energy and cost of copper possible for the conditions at hand.

A miniature system layout of this kind gives a very excellent opportunity, too, for investigating some things which are not readily found out in other ways. For example, the results produced by the wandering of the load from hour to hour could be very quickly analyzed, a matter perhaps more important in a railway system than in the case at hand, but easily determined in either case. Again, the disturbance produced by a severely fluctuating motor load and the proper means to remedy it could be ascertained very quickly and the long series of distribution problems which continually turn up would be found to yield readily to the same treatment, the instructional value of which is as great as its practical convenience. It is not often in these days that occasion arises for the analysis of the workings of a big and complicated purely direct-current system. Within its limitations the miniature distribution affords an easy way of getting at fairly close approximate results. An installation of this kind would be very instructive in an engineering school, both for exercise in problems of computation and for detailed study of what actually does happen in an intricate distribution, under conditions changeable at will to stimulate any ordinary or even accidental circumstances of load.

The Coming Issues

TOPICS of business policy and commercial applications in connection with the returning fall business of central stations, contractors, dealers and manufacturers, are emphasized in next week's ELECTRICAL WORLD, the commercial number for August. "Efficient Employees as an Element in Costs" is the subject of an interview with S. J. Dill, vice-president of the United Gas & Electric Engineering corporation, planned for that number. The remarkable flood-lighting equipment of the world's tallest building, the sixty-story Woolworth Tower, New York City, now permanently installed after preliminary experiments extending over a number of months, is the subject of an illustrated engineering article. An experience with the electric heating of a private dwelling recounted by the designer after practical observation of the equipment extending over several winters, offers some valuable suggestions for those who can utilize cheap energy for this purpose. The electrical equipment of an up-to-date family hotel, to be described in the same Aug. 26 number, points out the many uses for electricity in the modern hostely. Following its usual custom, the first issue of the ELECTRICAL WORLD for September will be its annual fall lighting number, with leading articles recording illumination practice and recent progress in street lighting. The second number of ELECTRICAL MERCHANDISING, the new monthly magazine which extends to the trade the editorial service of the ELECTRICAL WORLD organization, was issued this week under date of Aug. 15.

Chronicle of Events of the Industry and of Important Movements in the Field

NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

A.I.E.E. COMMITTEE APPOINTMENTS

President Buck Makes Announcement of Chairmen Selected and Changes Made in Technical Committees

The first meeting of the Board of Directors of the American Institute of Electrical Engineers for the administrative year beginning Aug. 1, 1916, was held in New York on Aug. 8. President Buck announced appointments on various Institute committees for the new year.

The chairmen of the committees designated are as follows: Finance, J. Franklin Stevens, Philadelphia; Board of Examiners, Dr. A. S. McAllister, New York; Editing, Prof. W. I. Slichter, New York; Meetings and Papers, L. T. Robinson, Schenectady; Sections, Walter A. Hall, West Lynn, Mass.; Public Policy, Calvert Townley, New York; Development of Water Powers, John H. Finney, Washington; Patent, Ralph D. Mershon, New York; U. S. National Committee of International Electrotechnical Commission, Dr. C. O. Mailloux, New York. Representatives were also appointed on various joint committees and other bodies. Additional committees of the institute, it was announced, will be appointed later.

The Board elected from its own membership Profs. C. A. Adams, C. E. Skinner and Dr. Harold Pender, to serve upon the Edison Medal Committee for the term of two years, to fill the places of members whose terms had expired.

It was voted to rename some of the existing technical committees as follows:

Old Name	New Name
Transmission	Transmission and Distribution
Railway	Traction and Transportation
Industrial Power	Committee on Electricity for Industrial and Domestic Use
Electric Lighting	Lighting and Illumination
Protective Apparatus	Protective Devices
Electrochemical	Electrochemistry and Electrometallurgy
Records and Appraisals of Properties	Committee on Economics of Electric Service

Upon recommendation of President Buck and the Meetings and Papers Committee, the decision made at the June Board meeting to hold an Institute meeting in Philadelphia in October and to omit the usual New York meeting, was reaffirmed.

It was also voted to hold the usual November meeting in New York, and an Institute meeting in Boston in December, omitting the New York meeting that month. In each case the Board of Directors will meet on the same date and in the same city in which the Institute meeting is held.

Upon the recommendation of the Board of Examiners fourteen students were ordered enrolled, 102 applicants were elected as associates, five were elected to the grade of member, eighteen were transferred to the grade of member, and two were transferred to the grade of fellow.

BID FOR JOLIET SITE ACCEPTED

Governor Dunne of Illinois Acts Favorably on Proposition Submitted by Sanitary District of Chicago

At a final conference on the transfer of the water-power site at Joliet, Ill., formerly leased to the Public Service Company of Northern Illinois and now transferred to the Sanitary District of Chicago, Governor Dunne of Illinois decided to accept the cash bid of the sanitary district in preference to the other bid of the sanitary district, known as Alternate B and mentioned in ELECTRICAL WORLD of Aug. 5. By the acceptance of the cash bid the Governor completed a twenty years' lease under the terms of which the sanitary district will pay the State $15.01 per horsepower for all power developed. The sanitary district is also placed under obligation to develop the present flow, amounting to 7000 hp., at once.

It is expected at the office of the sanitary district that a suit will be instituted enjoining the sanitary district from developing the water power on the ground that its charter as granted by the State Legislature does not permit it to engage in such work. If this case is decided in the courts favorably for the sanitary district, it is probable that active work on the development can be started by Jan. 1, 1917. If, however, it is necessary for the sanitary district to have its grant from the State Legislature changed, the time for beginning active work will therefore, of course, have to be extended further into the future.

WINNERS OF ELECTRICAL WEEK POSTER CONTEST

Society for Electrical Development Makes Announcement of Successful Design Chosen Out of 800 Submitted

Winners of the prizes in America's Electrical Week poster contest have been announced by the Society for Electrical Development. They are as follows:

First prize of $1,000, Harold von Schmidt, San Francisco, Cal.

Second prize of $500, John A. Bazant, Bronx, N. Y.

Public choice prize of $300, Vincent Aderente, New York City, N. Y.

Art students' prize of $200, Edward Staloff, Jersey City, N. J.

First school prize of $100, Harold H. Kolb,, Sommerville, Mass.

Second school prize of $50, William E. McKee, Jr., Hollywood, Cal.

Third school prize of $25, Armand Moreda, Brooklyn, N. Y.

Fourth school prize of $15, Ruth M. Jameson, Buffalo, N. Y.

Fifth school prize of $10, Edna E. Crowley, Chicago, Ill.

In this competition, which closed June 1, over 800 posters were received representing over $100,000 worth of designs. From this number the judges were instructed to choose the winners of all but the public choice

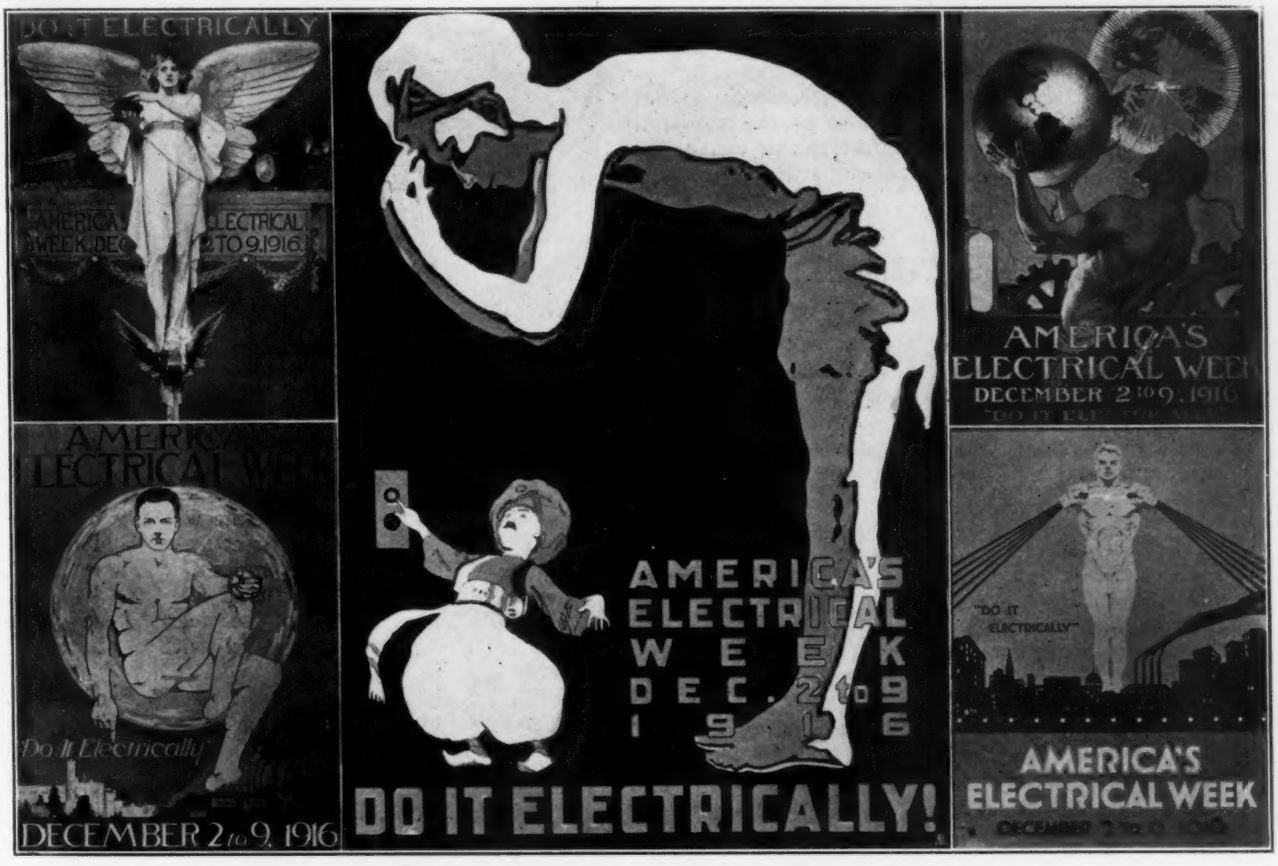
prize. For this prize, however, the judges were to select a limited number of designs. In this way the Society for Electrical Development relieved itself entirely from the judgment of the posters and placed all the responsibilities in the selection of the prizes upon this jury of awards, which was composed of John Quincy Adams, secretary of the Municipal Art Commission; Dr. James P. Haney, art director of the New York high schools; Herbert S. Houston, president of the Associated Advertising Clubs of the World; Arthur F. Wiener, president of the International Art Service; P. L. Thomson, advertising manager of the Western Electric Company; Henry L. Doherty, president of the Society for Electrical Development.

FRUEAUFF VIEWS PUBLIC UTILITY OUTLOOK

Past President of the N. E. L. A. and Doherty Organization Head Optimistic as to the Growth and Future of the Industry

In a recent issue of the *New York American* Frank W. Frueauff, past president of the National Electric Light Association and vice-president of Cities Service Company, gave his opinion as to the outlook and avenues of possible growth in public utilities. He said:

"Growth in electrical power includes power for heat purposes. Lighting used to be the big thing, now the power business is leaving it behind. Wherever there


DO IT ELECTRICALLY
AMERICA'S ELECTRICAL WEEK DEC. 2 TO 9. 1916
AMERICA'S ELECTRICAL WEEK
DECEMBER 2 to 9. 1916
"Do It Electrically"
DECEMBER 2 to 9. 1916
AMERICA'S ELECTRICAL WEEK DEC. 2 to 9 1916
DO IT ELECTRICALLY!
AMERICA'S ELECTRICAL WEEK
"DO IT ELECTRICALLY"
AMERICA'S ELECTRICAL WEEK

Winning Designs in "America's Electrical Week" Poster Contest

Center, "The Modern Aladdin," first prize and official design for the week; upper left corner, public choice prize; lower left corner, high school first prize; upper right corner, second prize; lower right corner, art student's prize.

The judges were unanimous in their choice for the design to represent the week shown herewith as the central figure. Grouped about the grand prize design are reproductions of the winner of the people's choice prize, winner of the second prize, winner of art students' prize and winner of first high school students' prize.

All of the designs which were selected by the judges and the public as prize winners, of course, are in many colors, particularly the ones which will officially represent the week. While many other designs might have been more attractive in the original, care had to be taken in choosing a design not only attractive but which could easily be reproduced in colors.

The central design in the group here reproduced will be used throughout the campaign on poster stamps, window and car cards, lithographs, bill posters, in newspapers, magazines, etc. It is estimated by the society that it will be reproduced at least 200,000,000 times. Next week the society will send out a booklet showing in colors the best posters submitted.

is an elevator to be lifted, or a printing press run, electric power is stepping in to do the work. Electrical power, eventually, will move everything.

"To sell electric power, in days not long past, used to be a matter of salesmanship. Now, with a central station in the neighborhood of any community in the country, that shows signs of expanding, electric power is being sought by every efficient plant, whatever its nature.

"Not long ago central stations considered themselves fortunate to have a 30 to 35 per cent load factor. Now they are not content with 60 per cent and are looking toward 70 per cent.

"Tractions will always be good, and they will always grow, but the rate will be very slow matched against that in the power field. Trolley lines, too, have to contend not only with the jitney, but with the privately owned auto. All over the country are people who own cheap cars, and they cut down traction revenues enormously in the aggregate.

"What has helped public utility growth is the industry's stable earning rate. Business depression hasn't had the effect on utility companies it has had on industrial concerns. As a result investors and banks are looking much more favorably toward public utility securities.

"In towns throughout the country the growth of the power load has outdistanced the growth in population. In a given time a town whose population has increased 10 per cent has seen the power load of the nearby central station expand around 50 per cent.

"Big manufacturing enterprises have all they can do to concentrate on the production of their particular products. Take the Willys-Overland plant in Toledo. That company's business is to turn out cars and to it they devote all their energies. The power to run their plant is our business and we expend all our energies in supplying that.

"This fall should witness excellent increases in power output and revenues in most sections of the country, and from the power inquiries we receive this expansion is going to occur in places where war orders are not a factor."

Chairman Weed on Transmission Line Easements

At a recent hearing upon a petition of the New England Power Company before the Massachusetts Gas & Electric Light Commission, Chairman Weed of the latter briefly discussed the relation between transmission line easements and capitalization, urging the importance of agreements between the various interests involved in such cases without appeal to a jury award. Mr. Weed said in part: "In case of land takings for pole or tower rights such as this is leading up to, I think the board's general attitude is that a company ought to pay liberally for whatever it takes. The only reason that legislation enabling transmission line locations to be secured was passed was because it became almost impracticable to run these lines across country without running against two serious difficulties: first, the absolute refusal of some land owners to give an easement at any price, and second, the insistence of others on a price which made the total cost of right-of-way very, very expensive.

"If the company had to pay that total cost at a very excessive figure, the burden of carrying that necessarily fell upon the people who would ultimately use the service, and it is because it is a public use and for the benefit of the public generally that such a line is run, that the Legislature allowed this rather qualified exercise of eminent domain. Under the circumstances we feel that the question that would first come to us probably, if a company should undertake to pay very excessive prices for easements and then come to us and ask us to authorize capital, would be to approve such expenditures; and if we found that they were paying excessive prices, I think we should decline to allow capital for anything more than the reasonable value of the right of way, so the companies are up against that problem. Now there is always a very great reason on both sides for adjusting a matter of this sort. Assuming that the easement is to be taken through eminent domain, then unless the landowners or trustees can agree with the company, the case must be placed before a jury and its award accepted. That is an extreme case of procedure unless there is a pretty substantial sum of money involved. It is expensive to both sides, and with a wide margin to trade upon both sides ought to endeavor to meet each other in a spirit of conciliation and try to reach a trading point."

MERGER OF IDAHO HYDROELECTRIC COMPANIES

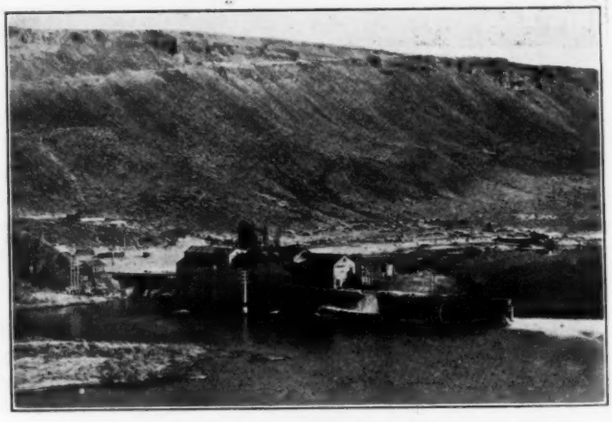
The Idaho Power Company Takes Over the Important Systems in the Southern and Western Parts of the State

A merger of Southern and Western hydroelectric power systems in Idaho has been perfected in the incorporation of the Idaho Power Company with a capitalization of $17,000,000. Only mere legal formalities stand

SHOSHONE FALLS, SNAKE RIVER, IDAHO
(OVER 200 FT. DIRECT FALL)

in the way to usher out the Electric Investment Company, which was organized to assist in perfecting the combination of all electric power plants of any consequence in the extensive electric field from Blackfoot on the east to Huntington, Ore., on the west, with the exception of the government plants at Burley and Rupert. The Boise Valley Traction Company, organized some time ago, remains the same, but all of its stock is held by the Idaho Power Company. Articles of incorporation of the latter company were filed with the Secretary of State.

While organized under the laws of the State of Maine, the Idaho Power Company is an Idaho institution. Twelve of its sixteen directors, or a majority, are Idaho residents, and will in the future govern its affairs. The



SWAN FALLS POWER PLANT, SNAKE RIVER, IDAHO

officers and directors of the Idaho Power Company are the same as the officers and directors of the Electric Investment Company. Merged into the Idaho Power Company are the Idaho-Oregon Light & Power Company, the Idaho Railway, Light & Power Company, the Idaho Power & Light Company, the Great Shoshone & Twin Falls Water Power Company, the Southern Idaho Water Power Company, the Jerome Water Works Com-

pany, together with a number of other properties which were controlled by these several companies.

The Idaho Power Company launches on its control of the southern Idaho field by operating in every city and town in the great Snake River Valley, except those two supplied with government power. It controls and owns plants at American Falls, Shoshone Falls, lower Salmon River Falls, Malad River, Swan Falls, Ox Bow and Horseshoe Bend. It leases the Boise Payette Lumber Company's plant at Barber, the United States reclamation service plant on the Boise River and the Thousand Springs Power Company plant in the Hagerman Valley. All told 30,000 hydroelectric horsepower is developed through plants owned or leased.

F. F. Johnson of Boise is president of the Idaho Power Company and William T. Wallace vice-president and general manager. Upon these two men largely falls the control of the corporation's affairs. The other officers are: Vice-president, George E. Claflin, New York; vice-president, D. F. McGee, New York; secretary and assistant treasurer, H. H. Burton, Boise; treasurer and assistant secretary, E. A. Wetmore, Boise; assistant secretary and assistant treasurer, E. P. Summerson, New York; assistant secretary and assistant treasurer, A. E. Smith, New York.

be gradually opened consistent with conditions and business judgment," said Manager Wallace. "There has been a tremendous scaling down of obligations through the organization of the Idaho Power Company, which starts out with very modest outstanding obligations. The result is that this company will be in a position to command capital and expand with the country. The slashing of obligations was necessary to bring such a situation about. In the past the old and independently-operated companies had to stretch their credit to the limit, and it became exhausted. The Idaho Power Company is not in this position, but starts out with greatly reduced obligations, greater credit, and is in a position with the various plants operated under one head to reduce the overhead expenses and give the public better service. There will be no duplication of systems and the necessary losses that are bound to follow such practice."

ATTITUDE OF CORPORATION TOWARD PUBLIC

Mr. Wallace was very frank in expressing the attitude of the new corporation to the public it serves and the way in which it is planned to meet the consumers half way or better. "The time when a corporation such as this could be operated independent of the wishes of the general public is past," he said. "There are but isolated cases where this attitude is now assumed by public service owners and managers. It has always been our business policy in the past, as it will be in the future, to deal with the public fairly and squarely. The public demands good service at reasonable rates. It is our desire to furnish both. As a public utility deals with the public, it must observe the rights of the public. That most certainly is our intention."

The incorporation of the Idaho Power Company is the result of a period of evolution in electrical matters in southern Idaho which has been in progress since 1907 and 1908 up to the present time. Many separate and independent companies entered this field, which gave excellent promises of development. Money from the East was spent by the thousands. Fields were developed in advance of their settlement or that the business war-

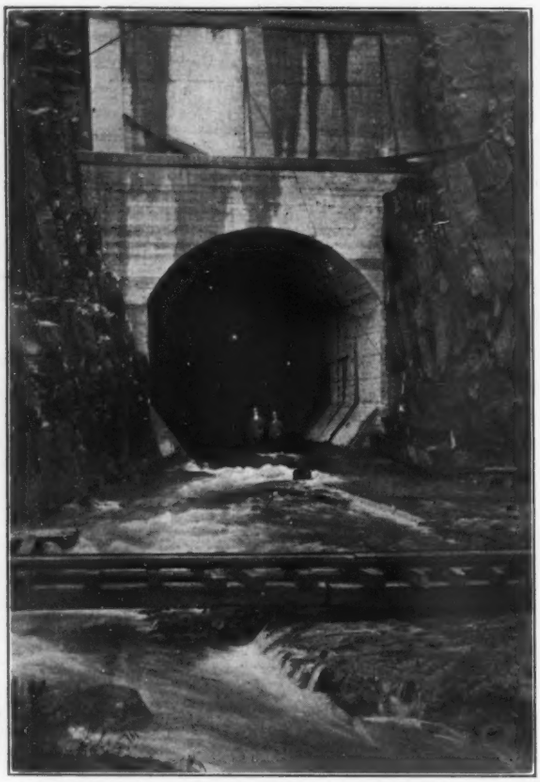
BIRDSEYE VIEW OF HORSESHOE BEND POWER PLANT, PAYETTE RIVER, IDAHO

The executive committee and board of directors follows: Executive committee: George E. Claflin, G. M. Dahl, F. F. Johnson and E. R. Tinker. Directors: C. C. Anderson, Boise; H. C. Baldridge, Parma; George A. Bremer, Jerome; George E. Claflin, New York; J. W. Cunningham, Boise; G. M. Dahl, New York; H. F. Dicke, Boise; James Duckworth, Blackfoot; H. J. Failing, Twin Falls; F. F. Johnson, Boise; O. G. F. Markhus, Boise; D. W. Standrod, Pocatello; E. R. Tinker, New York; E. A. Van Sicklin, Weiser; William T. Wallace, Boise; E. A. Wetmore, Boise.

STATEMENT OF GENERAL MANAGER WALLACE

"It is the business policy of the Idaho Power Company to provide capital for development of additional power as the field requires, to meet all demands and to keep just ahead of developments so that the field may

ranted. There was duplication of systems and cut-throat competition. The inevitable followed—failures and other financial difficulties. To clear the situation the Electric Investment Company was created to bring

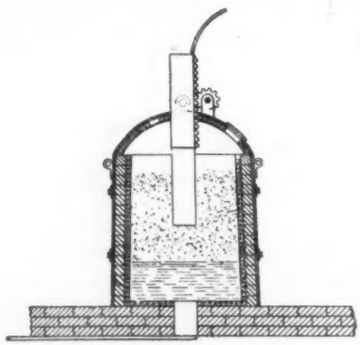


CONCRETE-LINED TUNNEL AT OXBOW POWER PLANT, SNAKE RIVER

about a combination of the duplicating companies. Gradually this company merged company after company of the larger type until the incorporation of the Idaho Power Company, which in turn succeeded it.

Method of Producing Corundum

A method has been devised by John Davenport, of Brighton, Mass., Patent No. 1,192,394, for producing corundum from the waste product or finely pulverized ore of garnet works. The "garnet flour," obtained as a



CORUNDUM FURNACE

by-product when separating the crystallized garnet from the crushed quartz containing ore, is mixed with a reducing agent, such as carbon, and by means of the electric furnace, not only is the abradant corundum obtained but also a ferro-silicon alloy which is useful in steel manufacture.

WATER POWER RESOURCES OF THE WINNIPEG RIVER

Department of the Interior of Canada Issues Report Showing Present and Prospective Developments and Their Commercial Significance

The Dominion Water Power Branch has just issued a report covering its investigations of the water power resources of the Winnipeg River, one of the large rivers of Canada. These investigations were commenced about four years ago, under the advice of two consulting engineers eminent in water power practice, John R. Freeman of Providence, R. I., and J. B. McRae of Ottawa, Canada, and have been continuously under way. J. T. Johnston, chief hydraulic engineer of the Water Power Branch, has had immediate direction of the investigations and is the author of the report, which is very interesting from both historical and engineering standpoints.

The engineering and economic aspects of the river for water power are, now, of great industrial interest, and a cursory examination of Mr. Johnston's report shows that there is no locality in Canada that is more fortunately situated in respect to water power than is the Province of Manitoba, particularly the city of Winnipeg. Chapter VI of the report covers in detail the comprehensive system of hydroelectric and power development by which it is proposed that the power resources of the river will be developed to their maximum advantageous use.

The report shows that there will eventually be as much, if not more, power available from the Winnipeg River than is now being developed at Niagara. The city of Winnipeg and the Province of Manitoba have, therefore, in the potential powers of the Winnipeg River, an assurance and guarantee of future industrial, commercial and municipal growth.

The investigations of which this report is the result were carried on by the Department of the Interior, primarily for administrative purposes. The work has covered a period of five years, and at a total cost of approximately $70,000. Expert and experienced engineering advice was obtained at the inception and throughout the investigations. Moreover, the government has spent over $104,000 in purchasing properties along the Winnipeg River from private parties, which were required for power purposes. The water power regulations under which these water powers are administered are thought by the Department of the Interior of Canada to be fair and reasonable to the owners, the developers and the users of the water powers.

The investigations show that at nine distinct power sites, by means of storage easily and cheaply accomplished at the Lake of the Woods, at Lac Seul and other lakes in the Province of Ontario, it is possible and economically feasible to develop over 418,000 continuous twenty-four-hour horsepower, all within 75 miles of the city of Winnipeg, and within feasible transmission distance of all commercial centers of the present settled portions of the province.

Of the nine possible power sites on the Winnipeg River, there are three now under development, representing a total power capacity of 200,000 twenty-four-hour horsepower. One site is completely developed by the Winnipeg Electric Railway Company on the Pinawa Channel, and produces about 28,000 hp. Another site at Point du Bois Falls, developed by the city of Winnipeg produces at the present time about 25,000 continuous horsepower, but is capable of extensions to a maximum of 77,000 twenty-four-hour horsepower. Development at the third power site at Great or du Bonnet Falls, having a maximum possible development of 95,000

twenty-four-hour horsepower, is about to be commenced by the Winnipeg River Power Company.

There is, therefore, at the present time about 53,000 continuous horsepower produced, and transmitted for use in and around the city of Winnipeg, which can, with the two present plants, be increased to 200,000 twenty-four-hour horsepower.

The six remaining power sites are under the control of the Dominion government, and can furnish a further amount of twenty-four-hour power to a maximum extent of 218,000 hp.

In addition, there are several important power sites on the Winnipeg and English Rivers within the Province of Ontario, which are within easy transmission distance of Winnipeg.

Lower Power Rates for 135 Illinois Towns

The Public Service Company of northern Illinois has made changes in its "Rate C for large light and power service," which will effect an annual saving of approximately $38,000 for its consumers. The change affects practically all of the company's power customers in its 135 towns. It has been stated that the reduction is merely evidence of a continuation of the company's existing policy to reduce its rates as rapidly as the condition of the business will warrant.

In the schedule which was previously in effect the company's demand charges were:

$3.20 per month per kw. for the first 20 kw.
$2.20 per month per kw. for the next 30 kw.
$2.00 per month per kw. for the excess of 50 kw.

The energy charges which were an additional charge for all electricity used were:

6 cents per kw.-hr. for first 2000 kw.-hr. per month.
3 cents per kw.-hr. for next 3000 kw.-hr. per month.
1.1 cents per kw.-hr. for next 25,000 kw.-hr. per month.
0.9 cent per kw.-hr. for next 70,000 kw.-hr. per month.
0.7 cent per kw.-hr. for excess of 100,000 kw.-hr. per month.

The maximum demand was measured by instruments and was based on thirty-minute intervals. The discount for prompt payment was 10 per cent of the energy charge and the minimum charge was 50 cents per month per horsepower connected.

Under the new schedule the demand charges have been made as follows:

$2.50 per month per kw. for first 50 kw.
$2.00 per month per kw. for next 450 kw.
$1.50 per month per kw. for excess of 500 kw.

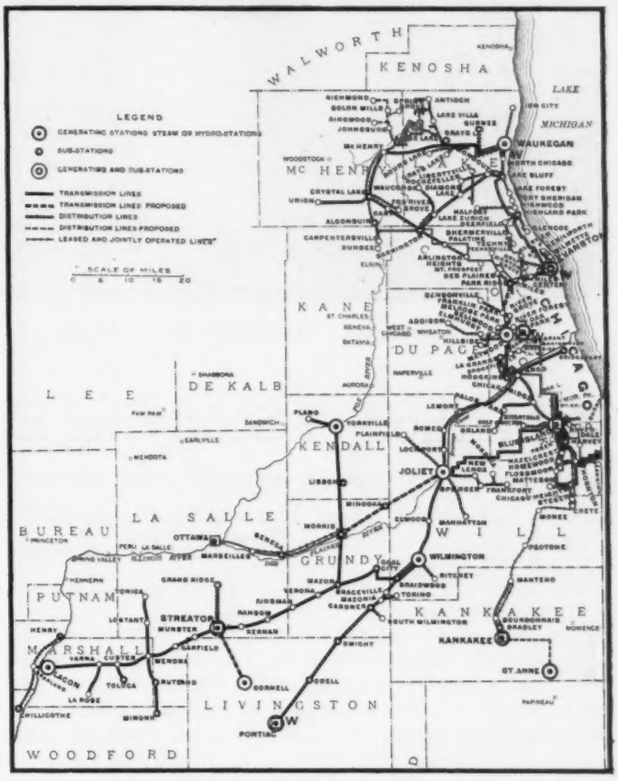
The energy charge under the new schedule in addition to demand charges are:

5 cents per kw.-hr. for first 1000 kw.-hr. per month.
3 cents per kw.-hr. for next 2000 kw.-hr. per month.
2 cents per kw.-hr. for next 2000 kw.-hr. per month.
1 cent per kw.-hr. for next 25,000 kw.-hr. per month.
0.8 cent. per kw.-hr. for next 70,000 kw.-hr. per month.
0.6 cent per kw.-hr. for next 400,000 kw.-hr. per month.
0.5 cent per kw.-hr. for excess of 500,000 kw.-hr. per month.

It is of particular interest to note that the maximum demand under the new rate will be determined in accordance with the following table and not entirely by instruments as was previously the case.

Where installation is under 10 hp. (only one motor) ... 85 per cent
Where installation is under 10 hp. (more than one motor) ... 75 per cent
Where installation is from 10 hp. to 50 hp. (both inclusive, irrespective of number of motors) ... 65 per cent
Where installation is over 50 hp. (irrespective of number of motors) ... 55 per cent

The company reserves the right, however, to measure the maximum demand by maximum-demand instruments, and the customer shall have the right upon request to have the maximum demand determined by maximum-demand instruments. In case the maximum demand is determined by maximum-demand instruments, the maximum demand in any month shall be the average number of kilowatts indicated or recorded in the thirty-minute interval in such month in which the consumption of electricity is greater than in any other thirty-minute interval in the month; provided, that in the case of hoists, elevators, welding machines, furnaces or other installations where the use of electricity is intermittent or subject to violent fluctuation, the company reserves the right to base the customer's maximum demand upon a five-minute instead of a thirty-minute interval and to require the customer to provide, at its own expense, suitable equipment to reasonably limit such intermittence or fluctuation.

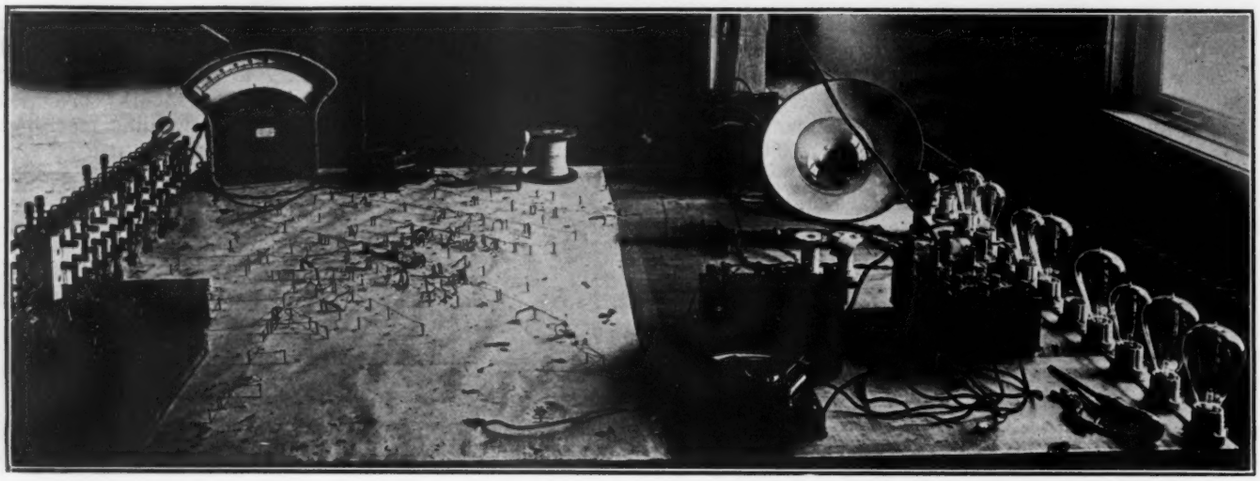


MAP SHOWING THE 135 COMMUNITIES SERVED BY THE PUBLIC SERVICE COMPANY OF NORTHERN ILLINOIS

The prompt payment discount has been made 3 per cent of the total charge and no change was made in the minimum charge.

New Transmission System to Connect Twenty-five Nebraska Towns

Robert B. Basham, who was formerly connected with the Insull interests and later with the McKinley interests on light and power projects in the Middle West, has completed arrangements in Chicago for financing a transmission company in northeastern Nebraska. The new concern, which as yet has not been named, will be capitalized at $300,000. Present plans do not contemplate the erection of a power plant. Negotiations are now under way for purchasing power from one of three available sources. The transmission system as it has already been planned will comprise 166 miles of transmission line passing through twenty-five towns with an aggregate population of 20,000. In these towns franchises, options and tentative wholesale contracts have already been secured. Among the towns to be supplied are: Winslow, Hooper, Scribner, Snyder, Dodge, Howell, Clarkson, Leigh, Creston, Humphrey, Cornlea, Lindsay, Newman Grove, Albion, West Point, Uehling, Oakland, Lyons, Bancroft, Rosalie, Walthill, Pender, Thurston, Emerson and Wakefield.



MINIATURE REPLICA OF EDISON THREE-WIRE SYSTEM USED TO STUDY COPPER DISTRIBUTION, VOLTAGE REGULATION AND VARIATION IN MAINS

A Method of Studying Edison Distribution Systems

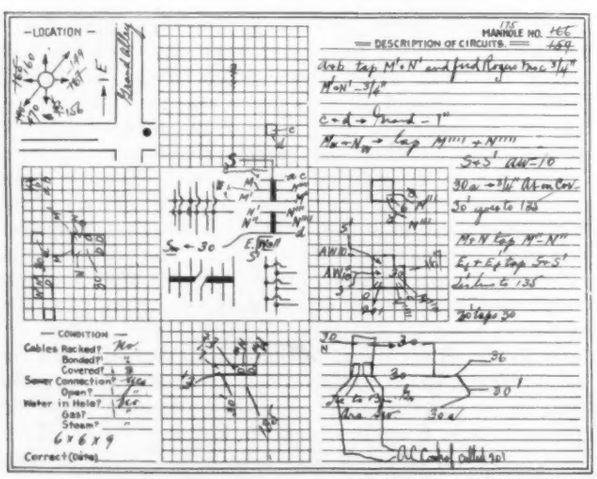
How an Investigation Was Conducted to Determine the Most Economical Distribution of Copper, Best Points to Connect Feeders, and Number of Bus Voltages by Use of Miniature Distribution System

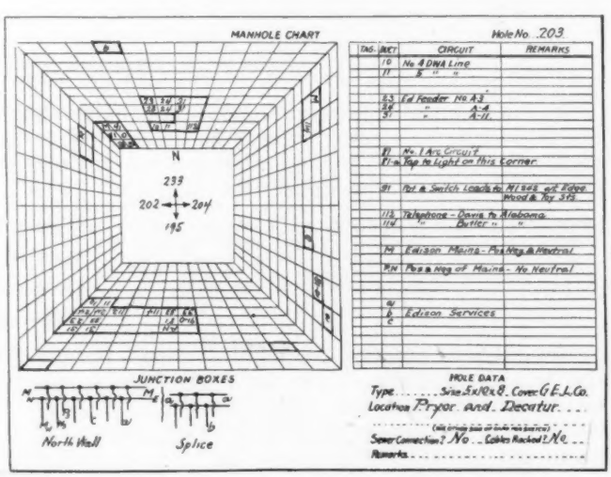
BY C. E. BENNETT

FOR a large system it is usually impracticable to calculate the potentials which will exist at various points in a distribution network under varying loads or to secure enough graphic voltage and current charts to permit comparing an actual Edison three-wire system with an ideal one. Therefore, when the writer, as electrical engineer of a large electric-service company, was called upon to recommend how the copper should be distributed to serve most economically, where the feeders should tap the network and how many bus voltages should be used, he adopted what was considered the most expedient method, that of duplicating the actual system in miniature and studying this under different conditions.

Owing to the incomplete records which were available on the load and on the size and location of cables, it was necessary first, however, to make a complete survey of the system and correlate the load records which were available. Since cable tags were lacking in most cases, and as there was no other way of identifying most of the cables due to their irregular arrangement in the manholes, the entire system, including manholes, subways and cables, had to be mapped out and the records finally matched up to permit drawing the entire distribution system. In many of the manholes the cables were under mud or water, in which cases the holes had to be cleaned out before work could be started. To facilitate mapping the position of the cables, and later permanently recording it for ready reference, forms like those of Figs. 1 and 2 were used. So that the records might be kept up to date, employees of the underground departments were provided with similar forms of Fig. 3 on which to indicate changes. It may be noted that any cable passing through several manholes may be identified by its position on the developed walls of the manhole. Every splice or other connection between cables and junction boxes was likewise shown on the cards, as well as all service from the network. The location of the manholes with respect to curb lines, condition of the holes and cables, and description of the circuits were also recorded on the forms.

Maps showing the exact layout of the duct lines,





FIGS. 1 AND 2—FORMS ON WHICH PRELIMINARY AND PERMANENT SURVEYS OF CABLE SYSTEM WERE RECORDED

feeders and mains as well as the service connections were also kept in loose-leaf form in a large binder, a page of which is reproduced in Fig. 4. This sheet, it may be noted, bears a map of the buildings along the street, the duct lines installed in the streets and various information regarding the manholes and cables installed in the ducts. Three transparent sheets were made to fold over this main sheet and to show the positions of the Edison feeders, alternating-current cables, telephone lines, Edison mains and service connections therefrom respectively. Tracings drawn to a smaller scale of the duct lines throughout the city were also filed in the binder in such form that they might be removed and used in making blueprints. All of the manholes were systematically numbered, the numbers being shown on the pages already referred to, as well as on the manhole charts, so that after a cable was located in a certain manhole its exact position in the duct line might be determined by referring to the manhole chart of the proper number.

ANALYZING LOADS FOR BLOCK DEMANDS

Other things which had to be determined before the miniature system could be constructed were the exact values of the connected loads, also what part of the various loads might be connected simultaneously and where the center of demand for each block might be assumed to exist. To determine this information the total connected load of every customer supplied with power from the Edison system and the actual power consumed by each during November and December were obtained from the contract department of the company. Conditions during November and December were desired since the heaviest loads occur during these months. Curves plotted from the connected load were then compared with the station load curves to obtain an idea of the ratio. Load curves were also obtained for a number of large buildings where the connected loads were relatively large to determine what proportions lighting and motor demands were of the total. These ratios were then tested by using them as a basis for figuring the monthly energy consumptions and the results compared with the consumption figure furnished by the con-

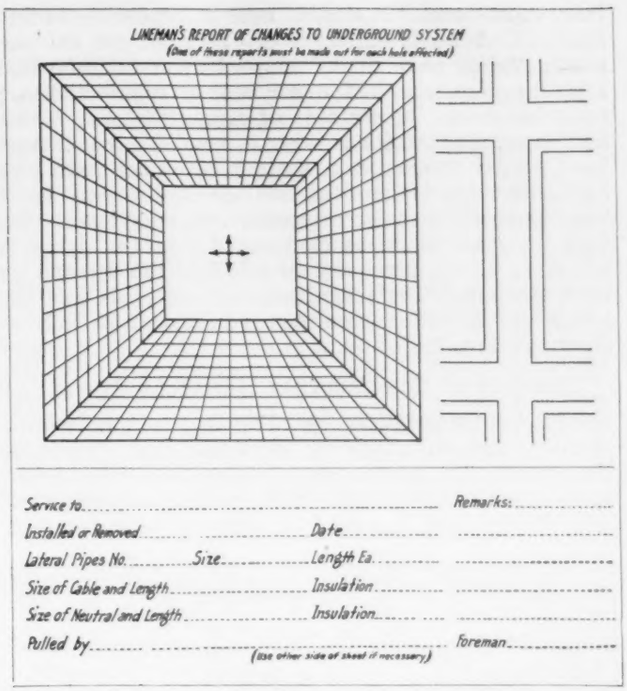


FIG. 3—FORM ON WHICH TO INDICATE CABLE CHANGES

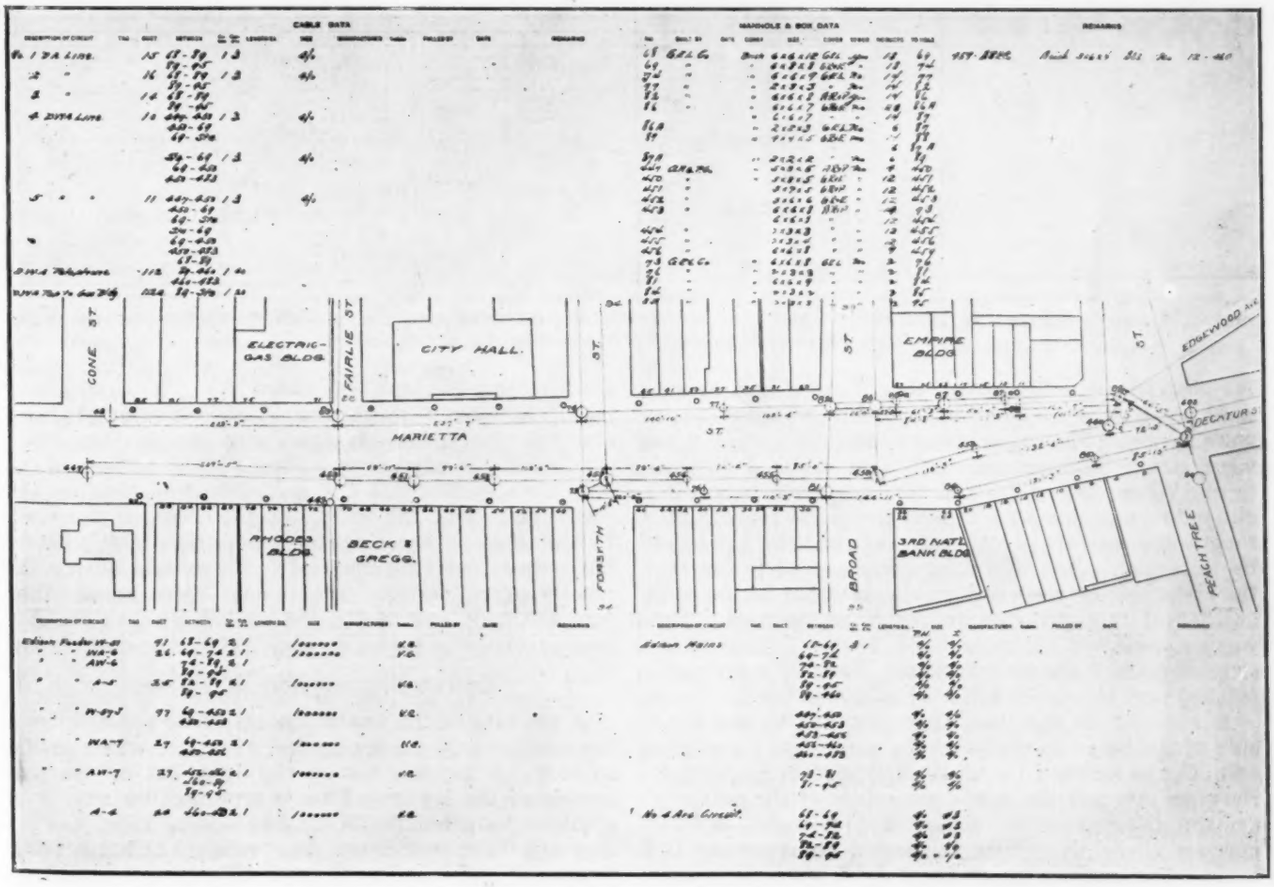


FIG. 4—MAP MADE OF TRANSPARENT SHEETS SHOWING DUCT LINES, VARIOUS CIRCUITS AND SERVICE CONNECTIONS

tract department. It was, of course, impossible to find figures that would satisfy every account, but the following ratios were finally adopted after many trials: Lighting demands, 16 2/3 per cent of connected load; motor demands, 25 per cent of connected load. These figures represented the average demand for the sixteen-hour period between 8 a. m. and 12 o'clock midnight. By using these factors, the total demand of each block was computed from the respective connected loads. Before the loads could be distributed over the network, however, it was necessary to calculate the demand on each manhole. The magnitudes of the loads and the points of application were then indicated graphically as shown in Fig. 5.

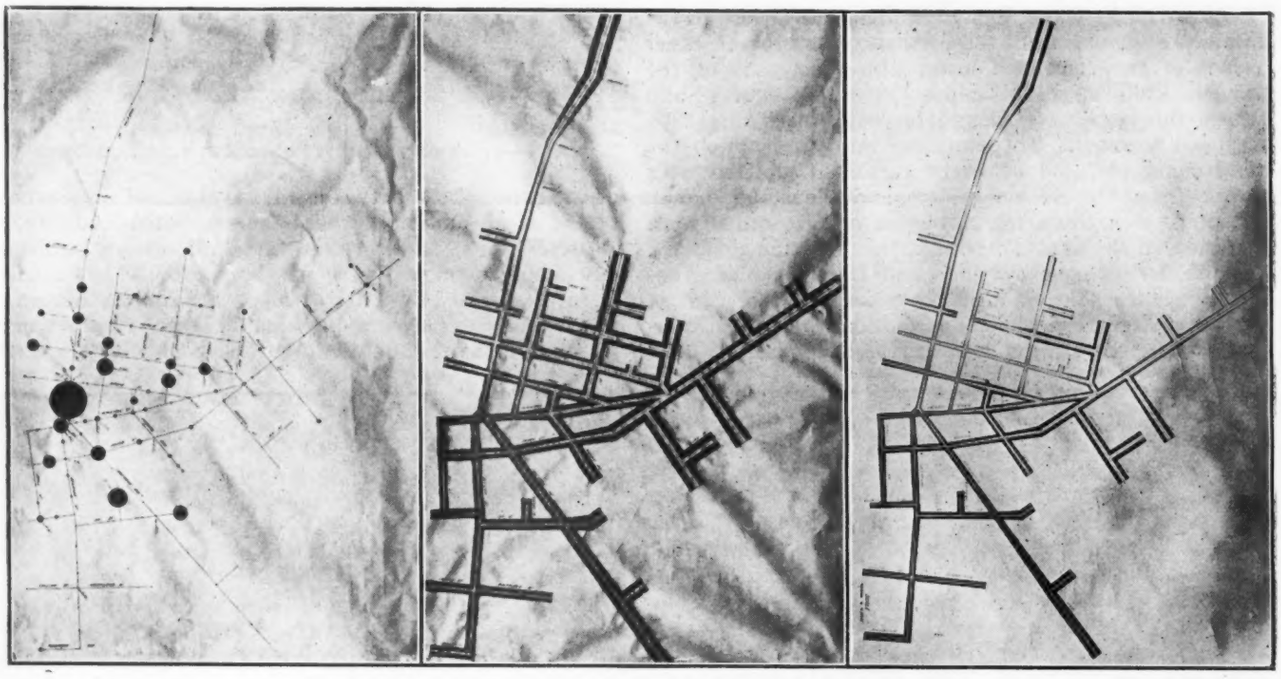
METHOD OF CONSTRUCTING MINIATURE SYSTEM

With the information regarding the size and location of cables, and magnitude and location of power demands, the construction of the miniature system was started. It was facilitated by pasting a large map (drawn to the scale of 100 ft. = 1 in.) of the direct-current distributing district on a flat board of soft wood and driving nails partly into the board at the points where manholes were located. Then to represent the cables, small wires were strung between the nails and soldered to their tops. Where the cables ran through a manhole without interconnecting with others, the wires representing them were separated from each other and the nail heads by insulation. The wires were made of such size that the resistance between any manholes would be the same as that of the corresponding cable represented. This was accomplished by using wires having 1/1200 of the cross-section of the actual cables. Thus to represent a 500,000-circ. mil cable, a No. 24 wire was used.

A network of wire was then fastened to the lower side of the board to represent the neutral of the system and offer as nearly an equipotential surface as possible. Between this and the miniature cables at the points of demand determined as explained previously, coils of german silver were then connected to represent the loads. The resistances of these coils were made such that 1/1200 of the current demanded by the actual loads would flow through them. Miniature busbars corresponding to those at the various stations were attached at a convenient place back of the layout and feeders run from the positive leg through knife-switches to the various tap-in points in the network.

Voltage was impressed on the miniature system through a lamp-bank rheostat so that it would be possible to vary the total current to correspond to the total load on the actual system at different hours of the day. Since the resistance of the system had been made equal to the actual system and the cross-section of conductors made 1/1200 of the cables represented, the current had to be kept within proportionate limits. For convenience in taking readings 1/1000 of the actual voltage was therefore impressed on the miniature system. Thus the potential drop in volts between any points on the actual system could be determined by reading the milli-volt drop between the corresponding points on the miniature system.

Losses in the mains were determined as follows: The station load curve for a peak load day was analyzed and the average currents calculated for the sixteen-hour period between 8 a. m. and 12 o'clock midnight, and also for the following eight-hour period. One-thousandth of this current was then allowed to flow in the miniature system and the milli-volt drop between the station bus and 280 points of the network observed. The averages of these readings were then multiplied by the average currents supplied to the system during the corresponding period. The sum of these results thus gave the daily loss during the annual peak, so the percentage loss was found by dividing by the daily input.



FIGS. 5, 6 AND 7—METHOD OF INDICATING MAGNITUDE AND POINT OF APPLICATION OF LOADS, VOLTAGE VARIATIONS AND REGULATION WITH ONE AND TWO-VOLTAGE BUSBARS RESPECTIVELY

COPPER DISTRIBUTION IN FEEDERS

In the case of the feeder system, quite opposite from the network system, the amount of copper which should be installed depends not on the drop, but on the economics of the layout. This is true because any drop, within reasonable limits, can be compensated for by varying the power-house bus voltage and operating feeders of different length from different-potential busbars. Therefore only enough copper should be installed

in feeders to make the annual charge against the feeder system a minimum for the load to be transmitted. This total charge is made up of the annual interest and similar charges against investment and the value in dollars of the energy lost in the feeders annually. Consequently, for the case under consideration, curves were plotted from actual calculations showing the value of the energy which would be lost per year in the feeders with different amounts of copper installed and with various loadings. The unit value of energy lost in cables was taken as $0.0075 per kilowatt-hour, since this was approximately the cost of energy at the switchboard. In addition straight-line curves were plotted to represent the annual charge against the investment. One line is plotted to show relation between overhead charges and amount of copper when interest at 6 per cent only is considered. The other curves indicate conditions when 2 or 4 per cent respectively are allowed for depreciation. The cost of copper was assumed at 47 cents, the approximate value of the size of cable which could be used most advantageously for this layout.

Since the ordinates of the hyperbolic curves indicate the value of energy lost per year with different weights of copper, and the ordinates of the straight lines indicate the interest and depreciation charge on the investment, their sum or the total charge is a minimum when the two components are equal. Thus the most economical weight of copper for a certain load and overhead charge is indicated below the intersections of the straight and hyperbolic lines. From a comparison of these values with the actual weights of copper installed in the feeders it was found that an excessive amount of metal was used in the feeders. Furthermore, the existing loss was only about half the most economical loss. In other words, the feeder copper was not being worked most advantageously.

FEEDING SYSTEM FROM DIFFERENT-VOLTAGE BUSBARS

To study the distribution of copper in the mains of the network similar tests to those made to determine the losses were conducted on the miniature layout. The potential differences between various points were measured and the results plotted graphically beside each circuit on a distribution map for comparison with the cable sizes. One of the maps on which the voltage differences have been indicated is shown in Fig. 6. The distance between the outside lines represent to scale the drop during peak load and the distance between the inside ones the drop during light load, the distance between these two sets of lines being the actual variation in voltage during the twenty-four-hour period. These charts were valuable in showing the relative drop throughout the system and illustrate very well that it is impossible to effectually compensate for this drop by simply varying the bus voltage. For instance, if the bus voltage is raised to compensate for drop in one locality, the voltage at all other points is correspondingly increased so the actual potential difference between points on the network remains unchanged. This graphical representation also served to show that operating the feeders from different voltage busbars would correct the conditions considerably, and also make these feeders share a greater portion of the load. The effect that such operation would have on the voltage differences was studied by making another series of tests with the miniature system fed from two different-voltage busbars, one bus being maintained at 15 volts higher than the other. The effect is shown by Fig. 7, in which it may be noticed that the width of the shaded areas between lines has been considerably reduced and the voltage variation over the entire system likewise improved.

Readings obtained from the miniature system were checked by connecting graphic voltmeters at various points in the network. The information thus obtained in connection with that obtained from the miniature system was employed in estimating the approximate average voltage at various points during different loads. In a general survey of conditions after this was done, it was noticed that the voltage differences between different points on the system were as great as 9.2 per cent and the regulation as poor as 8.7 per cent, whereas they should not have exceeded 5 and 3 per cent respectively. These observations indicated that in some places cables were of insufficient size. This condition was no worse than existed because, as previously pointed out, there was an enormous excess of copper in the feeders. If some of the metal in these could have been redistributed properly through the mains the conditions might have been remedied.

By conducting tests on the miniature system and operating the stations with double buses during peak

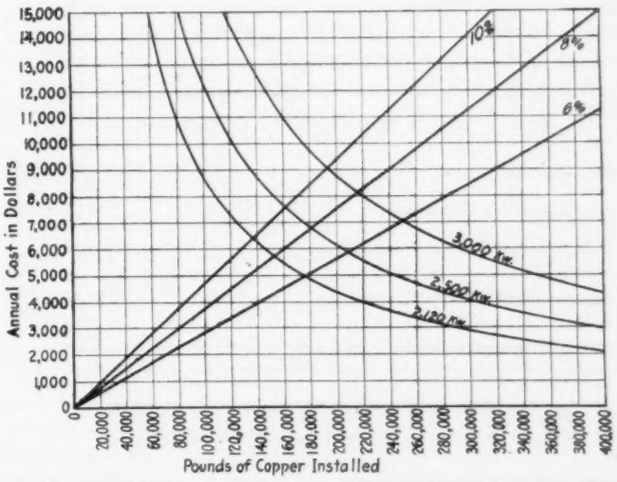


FIG. 8—RELATIONS BETWEEN OVERHEAD CHARGES AND AMOUNT OF COPPER INSTALLED IN DIRECT-CURRENT THREE-WIRE SYSTEM

loads, it was shown that the voltage variation over the city could be reduced to approximately 6.5 per cent and the regulation to 1.6 per cent without altering the distribution of copper. It was shown, however, that with the insufficient amount of copper in the mains the demand on each feeder was limited to the small network surrounding its terminus. Tests showed that the existing cables could be operated at current densities more proportional to their sizes by changing the tap-in points of some feeders.

In conclusion, the writer believes this arrangement of a miniature layout, although it may not give identical or parallel conditions with the exact system which it is supposed to reproduce, will give relative comparisons, and should be valuable as a means of checking up from time to time additions to and changes for electric railway or Edison systems where direct-current is used.

If this layout were made with extreme care and on the side of a wall approximately 10 ft. x 15 ft., quite accurate results could be obtained. By having a portable milli-voltmeter convenient, it is possible to solder on additional feeders at different points and then read off with ease the change in potential drop. The writer found this to be a most interesting study, and some of the readings obtained by experiment were even duplicated in the original layout.

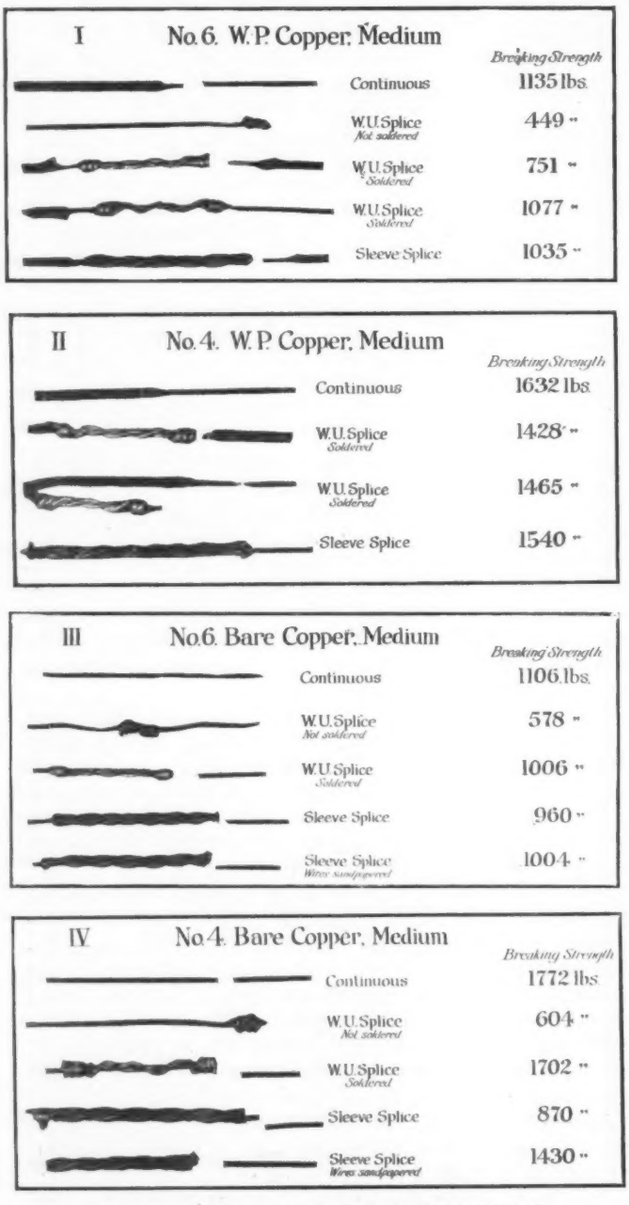
Another advantage of this method is that potential readings can be obtained at any part of the distribution experiments, when it is impossible to cut into the cables at any point along the line without great expense and inconvenience.

Mechanical Strength of Copper Wire Splices

Analysis of Comparative Tests to Determine Relative Strength of Splices with Different Grades of Copper and the Ability of Conductors to Stand Injury and Vibration

BY E. R. SHEPARD

THE Bureau of Standards has recently made a number of special transmission line studies in attempting to prescribe suitable sags in line conductors which would at once meet the requirements for proper unit stresses under the maximum assumed loading conditions and also provide reasonable assurance against their blowing together in the wind. A dilemma was encountered where the smaller sizes of wire commonly used in line construction were concerned in moderately long spans. The only escape from this dilemma appeared to be through the use of medium and hard drawn copper wire. The proposal to exclude the smaller sizes of soft drawn copper from long spans and from locations involving special hazards met with considerable opposition by transmission companies on the ground that medium wire is difficult to handle, does not lend itself well to the making of splices and taps and is more easily broken by rough handling and vibrations on the line than is soft wire. The claim is made by some operating companies, and is apparently a belief generally accepted, that medium and hard drawn wire has in reality only a hard shell and that the interiors of such wires are comparatively soft. It is further stated that slight injuries such as frequently occur when making splices and tying in conductors destroy the continuity of this hard shell or casing and often result in the early failure of the wires under service conditions.


I No. 6. W. P. Copper. Medium
Breaking Strength
Continuous 1135 lbs.
W.U. Splice Not soldered 449 "
W.U. Splice Soldered 751 "
W.U. Splice Soldered 1077 "
Sleeve Splice 1035 "
II No. 4. W. P. Copper. Medium
Breaking Strength
Continuous 1632 lbs.
W.U. Splice Soldered 1428 "
W.U. Splice Soldered 1465 "
Sleeve Splice 1540 "
III No. 6. Bare Copper. Medium
Breaking Strength
Continuous 1106 lbs.
W.U. Splice Not soldered 578 "
W.U. Splice Soldered 1006 "
Sleeve Splice 960 "
Sleeve Splice Wires sandpapered 1004 "
IV No. 4. Bare Copper. Medium
Breaking Strength
Continuous 1772 lbs.
W.U. Splice Not soldered 604 "
W.U. Splice Soldered 1702 "
Sleeve Splice 870 "
Sleeve Splice Wires sandpapered 1430 "

RESULTS OF TESTS FOR BREAKING STRENGTH OF COPPER WIRE SPLICES

Investigation has revealed the fact that the greater part of the weatherproof wire used in this country is soft drawn and few if any of the manufacturers carry any but this grade in stock. A few companies reported using medium wire for all classes of work with no particular difficulty encountered in the making of splices or otherwise. Some companies use medium wire for primaries and soft copper for secondaries and service wires, while others use what is supplied by the manufacturers and ask no questions. This lack of uniformity among the users of wire and the contradictory evidence regarding the properties of the several grades led to an investigation of the various points in question.

Tests were made on the mechanical strength of Western Union and sleeve splices and an investigation was made to determine the relative hardness of the surface and interior of different grades of copper as well as their ability to withstand injury and vibration. A number of the splices tested were made up by operating companies in different parts of the country for this purpose but the great majority of them were made up at the Bureau of Standards. Typical samples from over one hundred tests were selected as representative and mounted for exhibition. These are shown in the accompanying illustrations I to VII. The tension tests were made on a vertical Olsen testing machine which was capable of being easily read to within a pound or two.

TENSION TESTS ON COPPER SPLICES

In illustration I, specimens of No. 6 medium wire are shown. The full section of the wire broke at 1135 lb., or 51,100 lb. per square inch. A Western Union splice without solder broke at 449 lb., showing very little strength unless the splice is soldered. The next two specimens are Western Union splices made up very similarly but one was heated in the soldering process to a very much higher temperature than the other. One broke at 751 lb. at a point close to the splice where the effect of the heat had annealed it. The other wire was not heated to such a high temperature and went to 1077 lb., nearly the full strength of the wire. A sleeve splice failed at about the same as the soldered splice, 1035, which is practically the full strength of the wire.

Hard drawn wire or medium wire will anneal at about 250 deg. C., or perhaps something under that temperature if held there for some time. Solder will flow somewhere in the neighborhood of 190 deg. C. There is a margin which is not very great, some 50 or 60 deg. C., in which soldering can be done without any serious injury to the wire.

The failure of a soldered joint occurs not in the joint itself but usually just outside of the splice where the

wire has been overheated. If this weak section is kept below the annealing temperature a strong splice will result even though the middle region of the splice be heated to a much higher temperature. If the soldering can be confined to the middle region of the wire and not extended to the end turns which contribute little or no strength to the splice, a stronger joint will be obtained with less injury to the leading-in wires as well as with a saving of time and material.

All of the soldered splices tested were made up with a blow torch. Pouring from a ladle, however, is not so likely to overheat the wire and this method is exclusively used by some companies.

A second and similar illustration shows splices in No. 4 medium wire. The full section broke at 1632 lb., or 49,800 lb. per square inch. Two Western Union splices went to 1428 and 1465 lb. In one of these the wire broke about 8 in. outside of the splice, which may have been due to some injury there. Neither one was injured very much by the high temperature. A sleeve splice failed at 1540 lb. or about 95 per cent of the full strength of the wire. It requires from three to three and one-half turns in the sleeve to secure this high per cent of strength.

The third illustration shows No. 6 wire, which was supplied by one of the manufacturers and said to conform to the maximum requirements for medium copper, namely, 56,000 lb. per square inch for that size. The strength of the full section is 1106 lb., or 53,700 lb. per square inch. A Western Union splice without solder broke at 578 and with solder at 1006 lb. Two sleeve splices broke at 960 and 1004 lb. The latter was sandpapered, that is, the wires were sandpapered before they were inserted in the sleeve. It was found that in every case where the wires were sandpapered before inserting them in the sleeve a greater strength was obtained, particularly on greasy bare wires.

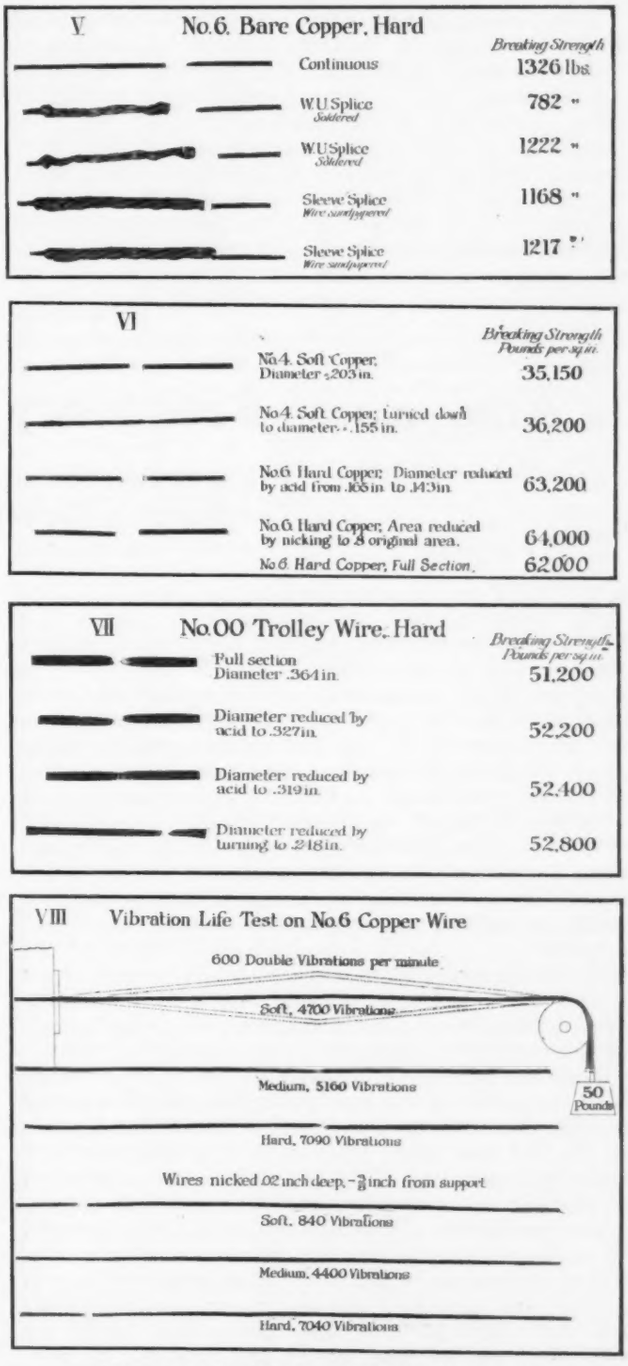
The fourth illustration shows No. 4 wire, said by the manufacturer to conform to the maximum requirements for medium hard drawn copper. The strength of the full section was 1772 lb., 604 that for the splice without solder, and 1702 for the splice with solder, which is only slightly below that of the full section. Two sleeve splices went to 870 and 1430 lb. The best one had been sandpapered. The value of sandpapering the wires has been questioned by some persons, but apparently there is some little difference, particularly if the sleeves are not twisted up very tightly. If we twist the sleeves sufficiently it is perhaps not necessary to sandpaper the wire. Neither of the sleeve splices shown in this illustration had been twisted sufficiently to secure their maximum strength.

The fifth illustration shows No. 6 hard drawn wire. The strength of the full section was 1326 lb., or 62,000 lb. per square inch. Two soldered joints broke at 782 and 1222 lb. The former had been heated to a higher temperature, though not very much higher than the one that broke at 1222 lb. In the small sizes it is very easy to overheat the wires and great care must be exercised. The larger wires conduct the heat away better and are not so liable to be overheated. Two sleeve splices broke at 1168 and 1217 lb. Both of them had been sandpapered. Sleeve splices with proper care can be made to develop practically the full strength of the wire or within a few per cent of the full strength.

Illustration No. 6 shows several samples on which some tests were made to determine the effect of nicking and otherwise reducing the section of the wires. The first specimen is a soft copper wire which broke at 35,150 lb. per square inch. The second was turned down to 155 mils from 205 mils and it broke at 36,200 lb. per square inch. The object of this test was to see if the machining had a hardening effect on it. The unit strength after turning was a little greater. It is possible that there is a hard surface put on by the machine tool and it was preferred to use the etching process rather than the machining on other specimens.

A No. 6 wire which was etched down with acid from 165 to 143 mils broke at 63,200 lb. per square inch. The corresponding figure for the full section is 62,000 so that it had been raised from 62,000 to 63,200 by taking off the outer shell, showing that the unit strength of the core is a little greater than that of the full section. This difference, however, may be due to observational errors in obtaining the diameter of the specimens. These experiments were continued on No. 2/0 trolley wire, hard drawn, where similar results were obtained. Illustration No. 7 shows these specimens.

From these tests we would judge that the core of the wire is just as hard as the shell. To substantiate this



BREAKING STRENGTH OF COPPER WIRE AND EFFECT OF VIBRATION ON LIFE

Dr. Merica of the Metallurgical Division made some microscopic examinations of these wires. His results show absolutely no difference in the grain structure across the section of any one wire, but widely different structures between wires of different sizes and grades.

In order to determine the effect of injury and vibration on wires a vibrating machine was built and some vibration tests were made on a number of wires. We have not gone very far with this but hope to continue the investigation at a later date. The machine holds a piece of wire rigidly at one point. The other end of the wire runs over a pulley 2 ft. from the fixed end and a 50-lb. weight is hung to it so that the wire is at a tension of about 50 lb. A motor is belted to a crosshead which lifts the wire or vibrates it at the center point about 600 double vibrations per minute, giving it an amplitude of about 2 in. The wire fits in between two spools tightly to give a smooth vibration.

Tests were made on No. 6 wire, typical samples of which are shown in illustration No. 8. A number of tests were made on each grade so that these figures do not represent one test but the average of a number of tests. There was a fair agreement between the tests, but not a particularly close agreement in all cases. Soft drawn wires withstood 4700 vibrations before failure. Medium wires withstood a little more, 5160 vibrations and like the soft wires failed at a point where the deflection was the greatest. The hard wire, which is the very hardest wire we could obtain, failed at 7090 vibrations, nearly twice the number for soft wire.

Similar tests were then made on wires which were nicked or injured. The wires were all nicked with a gage file to exactly the same depth, 0.02 in., 3/8 in. from the fixed end. The swinging of wires on the line would naturally break them at the insulator or the splice near the insulator, where the nick occurred, which corresponds to the point of injury on these wires. The soft wires broke with an average of 840 vibrations. The medium wires withstood 4400 vibrations, not very much less than before their injury, and one of the wires tested broke at the point of maximum deflection instead of at the nick. The hard wires went to 7040, slightly below what they stood before being nicked, and in several cases broke at the point of maximum deflection rather than at the nick. On the average, however, it broke at the nick before it would break at the central point. From these incomplete experiments which we have conducted to date it would appear that for simple vibrations the harder the wire the better it will stand up. Soft wire seems to crystallize very quickly. It is realized that it is not always the simple vibration that determines the life of the hard drawn wire. If a hard wire is kinked and an attempt is made to remove the kink, the wire will break, while soft wire will not.

While hard and medium wire may in some respects be objectionable for general line use, it is believed that the experiments here recorded demonstrate that there are no serious limitations to its use. It has fewer disadvantages and soft copper more disadvantages, than have generally been recognized.

Analysis of Frequency in Oscillatory Circuits

A New Method of Determining the Frequencies and Coupling Co-efficients in Coupled Oscillatory Circuits

By Prof. G. W. O. Howe

When two separate circuits, each consisting of a condenser and an inductance in series, are coupled—that is, brought into such relative positions that an alternating current in one causes the induction of electromotive force in the other—an oscillatory discharge in one circuit will set up oscillations in the other circuit. If the two circuits are previously tuned—that is, adjusted until they have the same natural frequency—it might on first thought be expected that no other frequency would enter into the phenomenon. It is well known, however, that on one of the condensers being discharged through its inductance the oscillation is built up in the other circuit until that in the first circuit is reduced to zero, all the energy, except that unavoidably lost, having been transferred from one circuit to the other. The second circuit now takes over the rôle of the primary circuit and builds up the oscillation in the original circuit until the remaining energy has been restored, when the process begins *de novo*.

Described herewith is a simple method of determining the frequencies of the two oscillations which together give the phenomenon of the beats. The method depends on the fact that these frequencies are independent of the initial conditions of the discharge. The question as to whether the secondary circuit is carrying current or not, or whether the secondary condenser is charged or uncharged at the moment when the primary discharge commences, is important in determining the amplitudes and phases of the oscillations, but cannot affect their frequencies or their decrements, which depend solely on the constants of the circuits. If, now, the initial conditions can be so chosen that the amplitude of one of the oscillations is reduced to zero, the other oscillation will run its course without beats.

Consider, in the first place, two identically similar circuits consisting of a condenser of capacity C and an inductance L; let each circuit have a total effective resistance R, and let the two circuits be magnetically coupled owing to a mutual inductance M between them. Let the two condensers be equally charged and simultaneously discharged in such a direction that the mutual inductance increases the effective self-inductances. The discharge will occur identically in the two circuits, which are practically equivalent to a single circuit of capacity $C' = 2C$, inductance $L' = (L + M)/2$, and resistance $R' = R/2$, as shown in Fig. 1.

If we put $M/L = k$, and therefore $L' = (1 + k)\, L/2$, we see that, whereas either circuit alone has a frequency $f = \omega/2\pi$, where

$$\omega = \sqrt{\frac{1}{CL} - \frac{R^2}{4L^2}} = \sqrt{\omega_0^2 - \alpha^2},$$

$$\omega_0 = \frac{1}{\sqrt{CL}} \text{ and } \alpha = \frac{R}{2L},$$

the two circuits oscillating together in this manner have a common frequency $f' = \omega'/2\pi$, where

$$\omega' = \sqrt{\frac{\omega_0^2}{1+k} - \frac{\alpha^2}{(1+k)^2}}.$$

The second term under the root is so small that we may usually put

$$\omega' = \frac{\omega}{\sqrt{1+k}} \text{ or even } \omega' = \frac{\omega_0}{\sqrt{1+k}}.$$

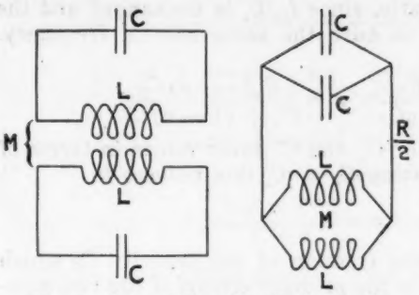


Fig. 1—Case of Two Identical Circuits which are coupled

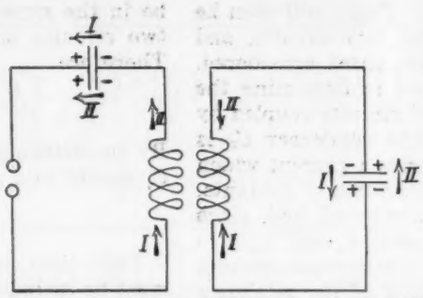


Fig. 2—Case Where Secondary Condenser Is Assumed Equally and Oppositely Charged

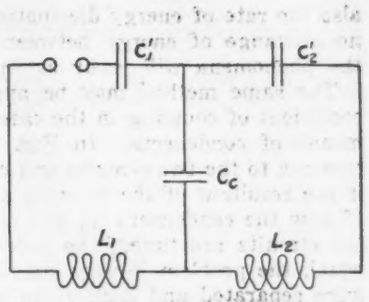


Fig. 3—Case Where Circuits Are Coupled by Condensers

If now the two condensers be simultaneously discharged, as before, but with the direction of the discharge reversed in one of the circuits, so that the mutual inductance has the effect of reducing the effective self-inductances, the two circuits will again oscillate side by side without any transfer of energy from one to the other. The two circuits act practically as one with a joint inductance L'' equal to $(L-M)/2$ or $(1-k)L/2$. The frequency of the oscillatory discharge is now $f''=\omega''/2\pi$ where

$$\omega''=\sqrt{\frac{\omega_0^2}{1-k}-\frac{\alpha^2}{(1-\kappa)^2}}$$

or approximately

$$\omega''=\frac{\omega}{\sqrt{1-k}},\quad\text{or even}\quad\omega''=\frac{\omega_0}{\sqrt{1-k}}.$$

From the formulas for w' and w'' it can be shown that

$$k=\frac{\omega''^2-\omega'^2}{\omega'^2+\omega''^2}.$$

Like the frequencies, the damping constants of the oscillations are unaffected by the initial conditions. In the first case

$$\alpha'=\frac{R'}{2L'}=\frac{R}{2L(1+k)}=\frac{\alpha}{1+k}$$

and the logarithmic decrement

$$\delta'=\frac{\alpha'}{f'}=\frac{\delta}{\sqrt{1+k}}.$$

In the second case

$$\alpha''=\frac{R''}{2L''}=\frac{R}{2L(1-\kappa)}=\frac{\alpha}{1-k}$$

and

$$\delta''=\frac{\alpha''}{f''}=\frac{\delta}{\sqrt{1-k}}.$$

If the initial potential difference to which the condensers are charged be V, then for either circuit alone the discharge current is given by the equation

$$i=\frac{V}{\omega L}\varepsilon^{-at}\sin\omega t.$$

In the first case this becomes

$$i'=\frac{V}{\omega_1 L(1+k)}\varepsilon^{-a't}\sin\omega' t=\frac{V}{\omega L\sqrt{1+\kappa}}\varepsilon^{-a't}\sin\omega' t$$

and in the second case

$$i''=\frac{V}{\omega L\sqrt{1-\kappa}}\varepsilon^{-a''t}\sin\omega'' t.$$

The ordinary case occurring in practice, in which the secondary circuit is free from charge or current at the moment of discharge, may be looked upon as the superposition of the two special cases considered above. The secondary condenser may be imagined to be equally and oppositely charged, thus giving no resultant charge. Both of these fictitious charges are assumed to be released at the same moment as the charge in the primary condenser. The latter may also be looked upon as made up of two equal charges, but of the same sign, each half corresponding to one of the fictitious secondary charges. This is shown in Fig. 2, where the currents and charges corresponding to the first case are marked I and those corresponding to the second case are marked II. The current in either circuit at any moment is the resultant of i' and i'' at that moment.

Hence

$$i_1=\frac{V}{2\omega L}\left(\frac{\varepsilon^{-a't}\sin\omega' t}{\sqrt{1+\kappa}}+\frac{\varepsilon^{-a''t}\sin\omega'' t}{\sqrt{1-\kappa}}\right)$$

and

$$i_2=\frac{V}{2\omega L}\left(\frac{\varepsilon^{-a't}\sin\omega' t}{\sqrt{1+k}}-\frac{\varepsilon^{-a''t}\sin\omega'' t}{\sqrt{1-\kappa}}\right).$$

It will be seen that the component oscillation which has the higher frequency has the greater initial amplitude, greater damping constant and greater logarithmic decrement, the latter being proportional to frequency.

It is not necessary, however, to assume that the two circuits are identical; they may have different values of C, L and R, so long as they have the same natural frequency and the same decrement. If $C_2=nC_1$, then $L_2=L_1/n$ where n is any number whatever. If all voltages in the secondary circuit are $1/\sqrt{n}$ of those in the primary, the currents will be in the inverse ratio and the energy in each circuit will be the same, as will be

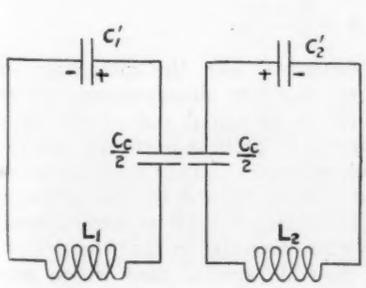


Fig. 4—Case Where Coupling Condenser Is Divided into Two Equal Parts

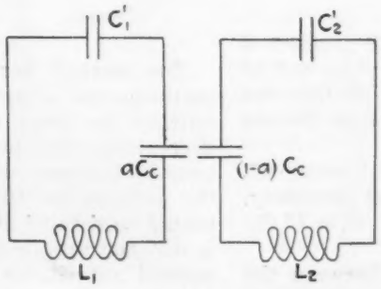


Fig. 5—Case Where Coupling Condenser Is Divided into Two Unequal Parts

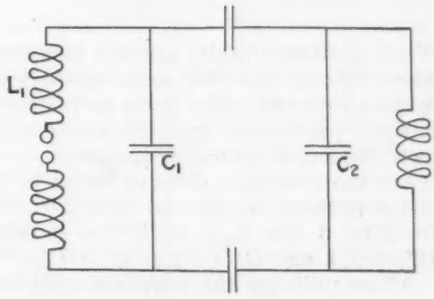


Fig. 6—Case Where There Is No Galvanic Connection Between Two Circuits

also the rate of energy dissipation. There will then be no exchange of energy between the two circuits, and the phenomena will occur as in the cases considered.

The same method may be applied to determine the coefficient of coupling in the case of circuits coupled by means of condensers. In Fig. 3 the condenser C_c is common to the two circuits and carries a current which is the resultant of the primary and secondary currents. If now the condensers C'_1 and C'_2 are equal, and, since the circuits are tuned, the inductances L_1 and L_2 also equal, the problem is very simple. If the two circuits were separated and each given a half of C_c, as shown in Fig. 4, they would have the same frequency ω', and, as we assume, the same decrement. If the two condensers C'_1 and C'_2 were equally charged as indicated in the figure and simultaneously discharged, the potential difference across each half of the coupling condenser would be the same at every moment and consequently the two halves could be joined without affecting the oscillatory discharge in any way. If the two halves are joined, Fig. 3 and Fig. 4 are identical. In the actual arrangement the total capacity of either circuit alone is $C_1C_c/(C'_1+C_c)$, whereas the total capacity of either circuit in Fig. 4 is $C'_1C_c/2(C'_1+\frac{1}{2}C_c)$. Since the inductance is unchanged, the frequencies are inversely proportional to the square root of the capacities, and it can be easily shown that

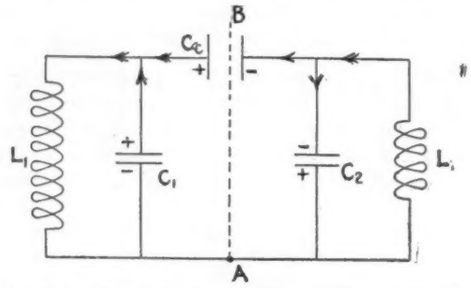


Fig. 7—Case Where Condensers C_1 and C_2 Are Charged to Different Potentials

$$\omega' = \omega\sqrt{1+\frac{C}{C_c}}$$

where C is the total capacity of either circuit alone and ω is 2π times its natural frequency.

If the charge of one of the condensers C'_1 or C'_2 in Fig. 3 be reversed, then on simultaneous discharge we shall have $C'_1C'_2L_1$ and L_2 in series and no current will pass through C_c, which is connected across two points of equal potential. The total inductance is $L_1+L_2=2L$, and the total capacity $C'_1/2$. In this case we have then

$$\omega'' = \omega\sqrt{1-\frac{C}{C_c}}.$$

From the well-known formula found above for the coupling,

$$k=\frac{\omega'^2-\omega''^2}{\omega'^2+\omega''^2},$$

it is found that

$$k=\frac{C}{C_c}=\frac{C'_1}{C'_1+C_c}.$$

When the two circuits are not identical the problem is more difficult since the coupling condenser must not be divided into two equal parts as in Fig. 4, but into two unequal parts such that the two circuits thus formed have the same natural frequency.

Let the necessary division be as in Fig. 5—viz., aC_c in the primary circuit and $(1-a)C_c$ in the secondary. In Fig. 3 let $L_1/L_2=C_2/C_1=n$, where $C_1=C'_1C_c/(C'_1+C_c)$ and $C_2=C'_2C_c/(C'_2+C_c)$.

After splitting the coupling condenser between the two separate circuits, the resultant capacities must still be in the same ratio, since L_1/L_2 is unchanged and the two circuits are to have the same natural frequency. Therefore

$$\frac{C'_1aC_c}{C'_1+aC_c}\times n=\frac{C'_2(1-a)C_c}{C'_2+(1-a)C_c}.$$

By substituting for C'_1 and C'_2 their values in terms of C_1 and C_2 and putting $C_2=nC_1$ this reduces to

$$a=\frac{-1\pm\sqrt{n}}{n-1}.$$

This, then, is the fraction of the capacity C_c which must be included in the primary circuit if the two separate circuits are to have the same frequency. To find the value of this common frequency, we have

$$\frac{\omega'^2}{\omega^2}=\frac{C_1}{C'_1aC_c/(C'_1+aC_c)}=1+\frac{\sqrt{C_1C_2}}{C_c}$$

or

$$\omega'^2=\omega^2\left(1+\frac{\sqrt{C_1C_2}}{C_c}\right)$$

In obtaining this, we have employed the positive sign for $\sqrt{n}$ in the formula for a. If we use the negative sign we get the formula for ω'', viz.,

$$\omega''^2=\omega^2\left(1-\frac{\sqrt{C_1C_2}}{C_c}\right)$$

From the formula $k=\dfrac{\omega'^2-\omega''^2}{\omega'^2+\omega''^2}$

we get for the coefficient of coupling $k=\dfrac{\sqrt{C_1C_2}}{C_c}$.

In taking the negative sign for $\sqrt{n}$ we are making use of a mathematical abstraction which has no physical counterpart, since it requires the capacity C_c to be divided into two parts, one positive and the other negative, e.g., $2.5C_c$ and $-1.5\ C_c$. The negative capacity increases the capacity C'_2 when placed in series with it. Since no dielectric is known which polarizes in the opposite direction to the applied electric force, negative capacities are impossible and the second arrangement with the natural frequency $f''=\omega''/2\pi$ cannot be realized experimentally.

The same method may be applied to another arrangement of capacity coupling—viz., that shown in Fig. 6. Here there is no galvanic connection between the two circuits, the only link being the dielectric of the two coupling condensers with a joint capacity of C_c.

If the condensers C_1 and C_2 are charged as shown in Fig. 7, but the primary to a potential difference n times that of the secondary, the quantities will be the same in the two condensers, and since the frequencies and the decrements are the same, the currents will be equal at every moment. An equipotential surface AB drawn from the connecting wire at A would pass between the plates of the coupling condenser, but would be n times as far from the left-hand as from the right-hand plate. If the equipotential surface AB be occupied by an infinitely thin conducting plate, it is evident that the oscillatory system on either side of it may be considered alone, without regard to that on the other side.

For the coefficient of coupling

$$k=\frac{C_c-C}{C_c+C}.$$

The method here described has the advantage of mathematical simplicity, but the disadvantage of requiring the two circuits to be tuned and of the same decrement. The former is of little importance since in practice the cases which arise are usually those in which the circuits are tuned. With regard to the latter, it should be pointed out that the assumption usually made is that the circuits have no damping, so that the present method substitutes a possible special case which may often arise for an impossible special case.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Angle-Iron Dead-End Cross Arms Considered Well Worth Their Cost

On all primary line and some secondary line dead-end poles, the Marion (Ind.) Light & Heating Company uses 2½-in. by 2½-in. by 5/16-in. by 5-ft. angle-iron cross arms. The Marion company purchases the iron and has it drilled in a local shop for a ⅝-in. through bolt and for ½-in. J-bolts at standard N. E. L. A. spacings. These arms cost $1.35 each, drilled.

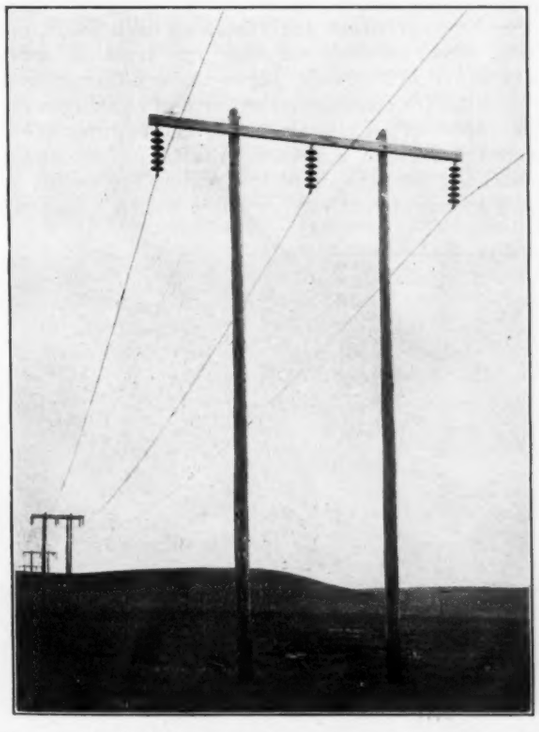
The fittings used with these arms are No. 2672 Locke strain insulators guaranteed to withstand a 4000-lb. strain, ½-in. J-bolts and ⅜-in. guy thimbles. The J-bolts are bolted into the holes in the arms and hold the Locke insulators in the hook of the J. The thimbles are used at the outer ends of the insulators to eliminate short bends in the line wires. The insulators cost the company about 36 cents each, the J-bolts cost 3.5 cents each and the thimbles cost 3 cents each. The material for a dead-end arm with this sort has been found somewhat more expensive than other forms of equipment, but the construction is considered enough better to warrant the extra cost.

Construction Costs for Two 100,000-Volt Montana Transmission Lines

The data of the accompanying table show a comparison of the unit costs of building two transmission lines which use the same size of line conductors and the same types of insulators, one line being of wood pole construction and the other of steel tower construction. Both lines operate at 100,000 volts, and were built under conditions which make them similar except in the use of supporting structures. These lines are operated by the Montana Power Company, one being known as the Great Falls-Butte (Mont.) steel tower line and the other the East Helena-Josephine (Mont.) pole line. The steel towers used are single circuit with horizontal crossarms. The wooden pole structures consist of two 45-ft. 8-in. red cedar poles supporting a single horizontal crossarm. The copper costs for the two lines have been reduced to the same base price, and the other data were taken from construction records.

UNIT CONSTRUCTION COSTS PER MILE FOR TWO 100,000 VOLT TRANSMISSION LINES USING NO. 0 COPPER CONDUCTORS

Wood Pole Line	Cost per Mile	Steel Tower Line	Cost per Mile
Pole structures	$203.80	Towers	$615.38
No. 0 copper wire	955.00	No. 0 copper wire	955.00
Ground wire	141.95	Ground wire	141.95
Telephone line	121.20	Telephone line	259.05
Insulators	239.50	Insulators	108.85
Cross arms	29.45		
Hardware	28.75		
Line switches	21.55	Switches	115.38
Creosote treatment	60.50		
Clearing	30.80	Unloading	14.23
Hauling	149.40	Hauling	181.33
Digging	61.20	Digging	165.55
Framing	40.20	Assembling	77.17
Setting	43.80	Setting	31.90
Stringing wire	87.50	Stringing wire	117.52
Guying	21.38	Guying	46.24
Guarding	3.59	Erecting	60.25
Survey	39.80	Survey	20.40
Camp	67.50	Camp	122.33
Tools	14.62	Tools	28.71
Roads	.13		
Hospital, injuries and damages	6.10		
Injuries during construction	.77		
General expense	55.00	General expense	128.52
Total	$2,423.49	Total	$3,189.76



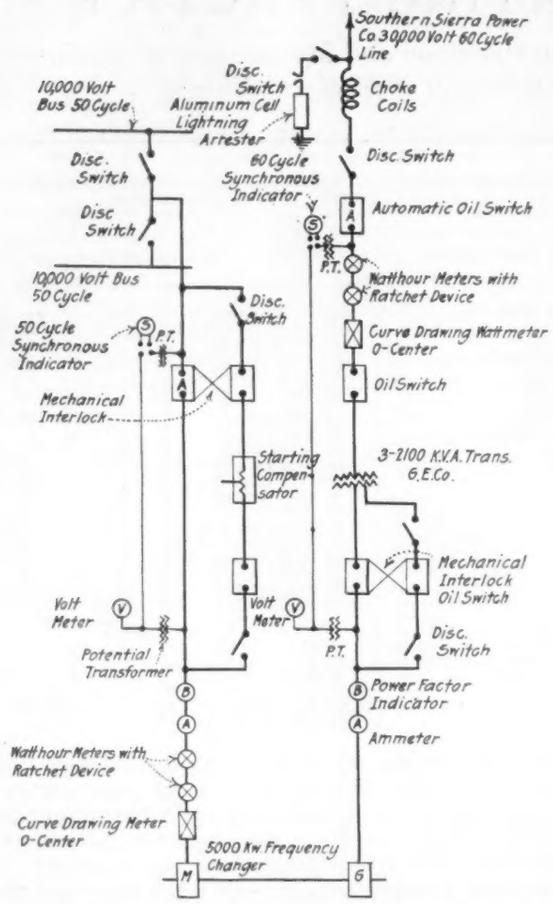
WOOD POLE 100,000-VOLT LINE SUPPLYING ENERGY FOR CHICAGO, MILWAUKEE & ST. PAUL RAILWAY

Tie Connection Between Two California Companies for Exchange of Energy

The accompanying diagram shows the connections for the operation of a 5000-kw. frequency changer in the Colton, Cal., substation of the Southern California Edison Company. This frequency changer makes it possible for this company to connect its 50-cycle system with the 60-cycle system of the Southern Sierras Company and exchange overflow energy up to the rating of the set. The set can be operated in either direction, as shown. The motor end is wound for 11,000 volts so that it can be connected directly on the 11,000-volt busbars of the Colton substation. The other or Southern Sierras end is wound for 6000 volts, the energy being stepped up through transformers to 30,000 volts of the Southern Sierras system. The set can be started from either end and both sides have a Tirrill regulator, making it possible to make adjustment for power factor of both systems.

Since the losses within the set are divided between the two companies, two watt-hour meters are connected in series and one pair on each side of the synchronous motor. These are ratchet-type meters so that one meter

will measure only the current flowing into the set from either system. The difference between the readings of the meters measuring the energy going in and the



CONNECTION BETWEEN A 50-CYCLE SYSTEM AND A 60-CYCLE SYSTEM THROUGH FREQUENCY CHANGER SET

meters on the other end measuring the energy going out represent the losses which are to be divided.

One of the immediate benefits of this installation is that the Southern California Edison Company is able to close down its steam plant in San Bernardino, permitting this plant to float on the line as a regulator and for emergency purposes. The frequency changer set thus takes the place of the steam plant and does the work required in an equally satisfactory manner. The installation has a further advantage in that it may possibly be used to delay the installation of additional generating units by either company so long as the other company has surplus energy available. It will thus be possible to postpone the investment in such additional equipment until a time when the new and additional installation can be fairly well loaded when put into commission. This feature, together with the reserve made possible in case of accidents or storms, makes the installation an important one for both companies.

Maintenance of Direct-Current Motors High in Flour Mills

BY R. L. HERVEY

The ease with which electric motors can be used as an independent drive for single machines or groups of machines as compared with other methods of drive and the absence of long lines of shafting and numerous belts, has been responsible for the progress individual motor drives have made in flour mills and bakeries. Apparently, the polyphase induction motor has met the demands of this class of work very satisfactorily. With the use of direct-current motors an unusual amount of commutator trouble has often been experienced, for the flying particles of flour collect on the commutator and form a hard cake which causes sparking and requires frequent cleaning. The use of inclosed motors has lessened the trouble to some extent. The under-cut commutator has given the most trouble, as would be expected, by the flour filling up the slots. By drawing a corner of a hack-saw blade through the slot and washing the commutator with a stiff brush and gasoline, the under-cut commutator can be kept quite clean, nevertheless a short-circuit will occasionally occur. In one bakery using thirty-six motors, ranging from ½ to 25 hp., 80 per cent of the repair work has been done on the motors exposed to the flour dust. The presence of black spots on the commutator is a common sight.

Polyphase induction motors of the wound and squirrel cage rotor types are being used successfully without being inclosed, even when in many cases the spaces between coils and the air ducts are partially filled. The attention of the motor tender obviates trouble from this source.

Use of Magnetic Clutches in Wisconsin Station to Operate Generators from Engines or Water Wheels

BY WILLIAM H. COSTELLO

The Wisconsin Traction, Light, Heat & Power Company makes an interesting use of magnetic clutches in its power plant at Appleton, Wis. The plant is combined steam and water driven, situated on the Fox River. The present equipment consists of two combined water turbine and engine driven direct-connected 1000-kw. units, running at 150 r.p.m., and two 1250-kw. low-pressure turbo-generators. The clutches are used to connect the engines to the generator shafts, the waterwheels being connected to the opposite end of the same generator shafts by means of flange couplings. There are two separate generators on each shaft, one a 550-volt direct-current machine for traction service, and the other a 2200-volt, three-phase alternating-current machine for commercial power and lighting service.

When operating by water-power the engines are disconnected from the generator shafts by disengaging the clutches. In seasons of low water, the supply may at times be cut off entirely on short notice, being regu-

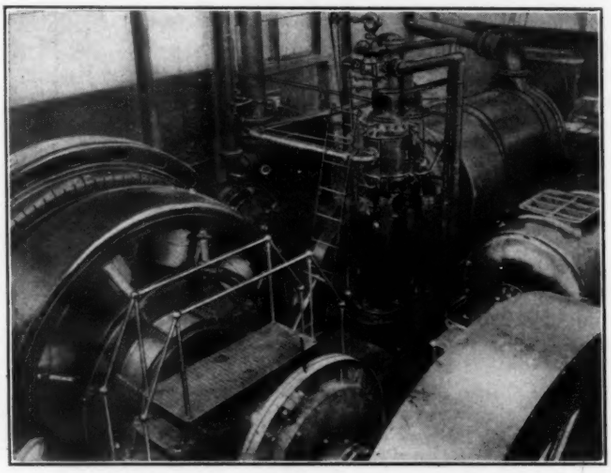


FIG. 1—MAGNETIC CLUTCH USED IN WISCONSIN STATION TO CONNECT ENGINE TO WATER-WHEEL GENERATOR

lated by the government, when it is necessary to drive the generators from the engines. In cases of sudden change, the engines must be connected to the generator

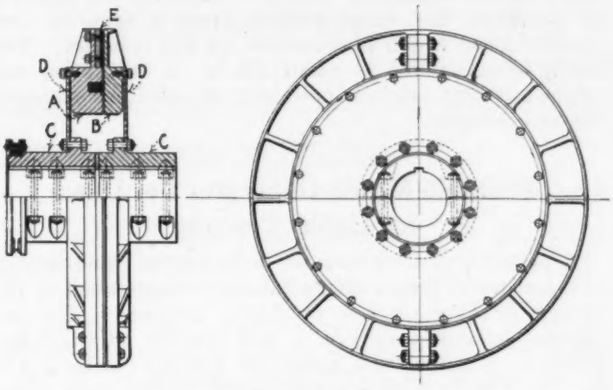


FIG. 2—CONSTRUCTION OF MAGNETIC CLUTCH USED IN WISCONSIN STATION

shafts without interrupting service. This is accomplished by means of the magnetic clutches.

The clutch used has several essential features which make it suitable for this service. The torque transmitted can never exceed a certain predetermined value, which insures smooth engagement and eliminates excessive strains. The operation of the clutch is, therefore, not dependent upon the skill of the operator, and may be thrown "full on" without harmful results. At the same time the clutch has a factor of safety which permits no slipping when the engine is running at its maximum load. It is designed to withstand moderate periods of slipping, and provision is made for dissipating the heat developed and adjusting for the resulting wear. It has been found that magnetic clutches of this type are well adapted for "inching," and by manipulating the knife switch which controls the clutch the engines may be turned through any desired fraction of a revolution.

The magnetic clutches replaced two mechanical friction clutches which had become unsatisfactory and required frequent renewal of parts to maintain them in operating condition. The principal cause of the failure of the mechanical clutches, it is said, was a slight misalignment of the engine and generator shafts which imposed unbalanced stresses on the clutch shoes, and which resulted in chattering and slipping on overloads. The construction of the units made it a difficult matter to correct this misalignment. It would have been necessary to use a flexible coupling in connection with any form of mechanical friction clutch, but the limited shaft length made this practically impossible. The misalignment mentioned does not affect the operation of the magnetic clutches.

At present the capacity of the plant is being doubled by the addition of two high-pressure steam turbo-generators and auxiliary equipment. It is also planned to take out the present water wheels and replace each wheel with two water turbines, direct connected to 650-kw., 4000-volt, alternating-current generators. This will leave the old generator equipment referred to driven by the engines only. Direct current will then be obtained by driving with the engines or by operating the alternating-current generator as a motor to drive the direct-current machine. The latter arrangement will be used when the load demand is light and the hydraulic turbines have more capacity than is required for the alternating-current service. The engines will then be used for synchronizing, and can be disconnected by means of the clutches.

The essential features of the clutches are shown in Fig. 2. They are 66 in. in diameter and 30 in. over all length. The construction consists of a field or magnet member, *A*, and an armature member, *B*, connected to the hubs *CC* by means of the steel disks *DD*. These disks act as spring plates to separate the field and armature members, when the clutch is de-energized. The coil, which is in the form of a ring, fits in an annular slot in the field member and connects to the slip-rings by flat external leads. The magnet or field member when energized pulls the armature against a friction ring, *E*, with a pressure of 75 lb. per square inch, the resultant friction giving the required torque. The success of the clutch lies in its simplicity and freedom from sliding parts to wear out and require adjustment. About 8 amp. at 110 volts are required for excitation. This current is furnished by an exciter set. A special split construction was used so that the clutches could be installed without removing the shafts.

The clutches were built by the Cutler-Hammer Clutch Company, and installed on the recommendation of the Woodmansee-Davidson Company of Chicago, consulting engineers for the Wisconsin Traction, Light, Heat & Power Company.

Selecting Furnace Grates That Will Have Long Life and Low Maintenance

BY R. I. ELKINS

It was pointed out by the writer in the April 22 issue of the ELECTRICAL WORLD how the unequal deterioration of the grate bars in furnaces, especially in hand-fired boilers, can be greatly relieved by the proper proportioning of the air spaces between bars so that the cooling surface of the grates at the front of the furnace is increased with more careful and even firing. Another matter closely allied to this matter that increases the life of the bars is the maintaining of an even or regular surface of the grates at the fuel bed.

If a fire is properly fired the grates should wear fairly evenly. They may sag downward or arch upward, it mattering little which. In the latter case they will often be found to fail from fracture, whereas sagged bars that appear to be in further progress of deterioration will still remain intact. Often it is found that the bars are operating quite satisfactorily until they have been taken out and placed back in the furnace again, when they start to warp and burn and break comparatively rapidly thereafter. The reason for this is that when the bars were placed back in position sufficient care was not taken to see that a regular and even surface was offered to the fuel bed, with the result that the heat of the fire and the attack of the fireman's slice bar combine to destroy the grate rapidly. Nothing is more deleterious and tends to cause rapid deterioration and shortened life of the grate bars than uneven and irregular grate surface. When grates are taken out each bar should be numbered, taking care to replace them in the same position as they were before.

The correct proportioning of grate bars plays an portant part in their life and maintenance, and a change in this respect will often solve excessive depreciation. A thick bar will usually be found to have a longer life than a thin bar, which appears contrary to what one might at first be led to expect. It is often argued that the thin bar should render longer service than the thick because it offers less surface for the hot fire to attack. In practice this is not found to be the case, because the heat absorbed by the grate consists not only of the heat absorbed by direct contact with the burning fuel, but also by radiation through the interstices. Under these circumstances the thinner the bar the less material will there be available for permitting

the dissipation or transfer of heat, and the higher will be the temperature of the bar. The thin bar will not only operate at higher temperatures than the thick bar, but since it has a smaller cross-section it will have less rigidity to withstand the stresses and strains incidental to normal operation. Being thus weaker mechanically the thin bar will be more likely to warp and bend sideways, making contact with adjacent bars, and in this way causing wasteful enlargements of the air space and further diminishing the cooling surface. The thick bar has less tendency to do this. Another point in its favor is the fact that it is better able to sustain a layer of protecting ash, in this way maintaining the fire somewhat farther removed from its own surface. The effect of these features helps in securing longer life.

In choosing a grate bar several factors should be taken into consideration, of which the more important are the length of the bar, the amount of fuel burned per square foot of grate area per hour, and the width of the intermediate spaces. The latter is a factor that largely decides the temperature at which the grate will operate and is, therefore, an important one. Unfortunately it often receives less deliberation than it deserves. In choosing the bars it should be remembered that the grate having the wider air spaces will be subject to the higher temperatures due to radiation of heat than one with a smaller air space, and the cross-section of metal should therefore be increased in order that there may be increased capacity for heat transfer.

It is not an easy matter to figure the cost of repairs to boilers, whether it be the grates or not that are undergoing repair, because much depends upon the service supplied by the boiler, the time at which it is out of service, and the amount of reserve capacity available at such times. The more important the installation the greater is the importance of long grate bar life. In Europe steel and wrought iron are used quite extensively for grate bars, whereas in this country cast iron finds little competition because of its lower initial cost. However, as the capacity of units increases and the value of keeping a machine in service becomes of more and more importance, the indications are that steel and wrought iron will find increasing favor. Steel and wrought-iron bars are higher in first cost than cast iron, but the expense for maintenance is lower. When a steel or wrought-iron bar warps or breaks it may be straightened by heating or repaired by welding or forging at a low cost, whereas the cast-iron bar must be scrapped. The steel and wrought-iron bars also constitute a smoother surface to the fire bed, making barring and removing of clinker easier. The real economy of grates is not in their first cost, but in the cost of their maintenance.

Applying Cement Lining to Coal Hoppers

The Commonwealth Edison Company, according to its custom, is taking advantage of this season of the year to overhaul and clean those of its turbo-generators needing attention. They are also finding this an opportune time to line the coal hoppers at the Fisk Street station with cement. It is generally known that coal causes deterioration of steel, and where the coal is moist, as it is in the hoppers, and where the hoppers are filled with coal almost all the time, the corrosion is quite rapid. The hoppers at Fisk Street have been in service a number of years, and it is to prevent further corrosion and permit the hoppers to be of use for a number of years to come that they are being lined with cement.

After the rust has been removed, which is incidentally the most troublesome part of the procedure, the steel is painted with rust-resisting paint and wire mesh fastened in place. The cement is then applied by spray or a cement gun. The mixture is shot through the hose under pressure of air between 40 and 60 lb. per square inch. Before emerging from the nozzle the dry mixture is hydrated, the water coming from a separate and smaller hose, which is controlled by the operator. The lining thus applied is about 3.5 in. in thickness, and offers a smooth surface, not easily abraded nor susceptible to corrosion.

Portable Motor-Generator Set Used for Cable Testing

A portable motor-generator set used for cable testing is a feature of the auxiliary substation equipment of the Worcester (Mass.) Electric Light Company. The apparatus is shown in Fig. 2 and consists of a 2.5-kw. 500-volt, direct-current generator belt driven by a 4.5-hp., 60-90-volt direct-current shunt motor, both units running at 2000 r.p.m. The machines are mounted on a frame of 3.5-in. by 5.5-in. timbers 6 ft. 6 in. long and

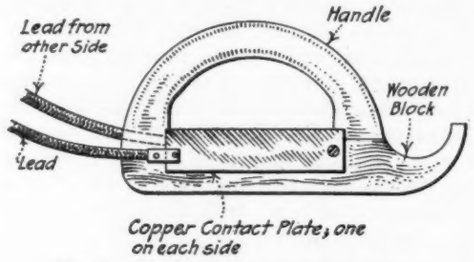


FIG. 1—TESTING AND SERVICE PLUG

20 in. wide over all. The field rheostat of the generator and the motor-starting resistance are attached to the frame by 1.25-in. by 0.1875-in. angle irons as shown.

The testing and service plugs used are shown in Fig. 1. Each of these consists of a wooden block 6.5 in. long and 1.375 in. wide, treated with paraffin, and fitted on either side with a 1-in. by 3.25-in. by 0.9375-in. copper contact plate to which the cable lead is attached by a screwed lug. The end of the plug is curved upward and each outlet into which the plug fits is provided with a small U-shaped hook at the upper end, which forms a temporary lock to hold the plug in position. It is therefore impossible for the plug to fall out by its own

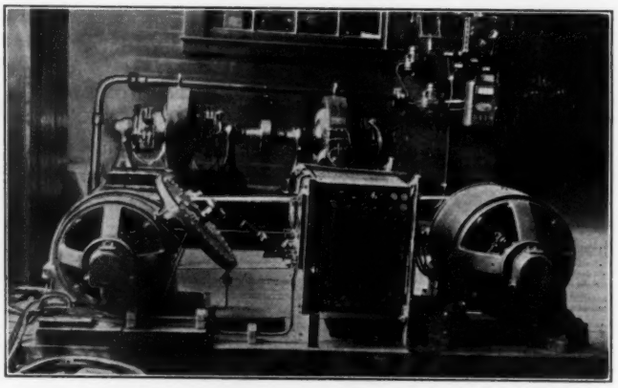


FIG. 2—MOTOR-GENERATOR SET MOUNTED FOR PORTABLE USE

weight, although easily removed by a well-directed pull. The plug connects with copper clips on the outlet block. These plugs are also used on the company's service for automobile charging, and eliminate the trouble sometimes encountered through the pulling out of cable terminals when a machine is suddenly started. They were designed by Arthur Putnam of the company's engineering department.

COMMERCIAL AND BUSINESS POLICY

A Department of Plans and Methods for Widening the Application of Electricity and for Extending Electric Service

PROVING THE ECONOMY OF ELECTRIC COOKING

Figures on Electric Ranges in Service in Boulevard Court Apartments, Detroit, Show Average Daily Use of 2 Kw.-Hr. per Family

Figures recently secured on the cost of operating twenty-nine electric ranges in the Boulevard Court Apartments, Detroit, Mich., give 2 kw.-hr. per day as the average consumption for cooking for families of two and three persons. In the same apartments the use of electrical energy for purposes other than cooking averaged a trifle above ½ kw.-hr. per day during the period of observation. In only one instance was it apparent that the electric range was not being used regularly, the consumption in the other twenty-eight cases varying from a minimum daily consumption of 0.44 kw.-hr. to a maximum of 4.4 kw.-hr. per day.

The ranges installed are a recent model made by the Standard Electric Stove Company of Toledo, the feature of which is the compartment (or fireless) cooker. This cooker is set into the body of the stove so that its cover when closed is flush with the cooking surface and is flanked on either side by a hot plate. The oven is of the elevated type with a glass door. An automatic clock mechanism operates a master switch and pilot lamp, this feature being designed to prevent the circuit being left "on" through forgetfulness upon the part of the operator.

The Boulevard Court installation was made as a direct result of a similar successful installation in Buffalo. A tenant of the Buffalo apartment upon moving to Detroit inquired of the manufacturer to learn whether she could not secure an apartment in the latter city equipped with an electric range. This evidence of satisfaction induced the Edison Illuminating Company of Detroit to join forces with the manufacturer in placing a typical installation.

ONE OF THE ELECTRIC RANGES IN THE BOULEVARD COURT APARTMENTS, DETROIT

A study of the subjoined data will reveal several in-

FIGURES ON CONSUMPTION AND COST OF ELECTRIC COOKING BY TWENTY-NINE ELECTRIC RANGE USERS, BOULEVARD APARTMENTS, DETROIT

Floor	Apartment	Period of Observation: From	To	No. of Days	Kw.-hr. Consumed Other Than by Range	Monthly Cost of Energy Other Than for Cooking	Kw.-hr. Consumed by Range	Monthly Cost for Operating Range	Total Kw.-hr.	Total Cost	Total Monthly Cost
First	1	4/28	6/30	63	26	$1.07	167	$3.18	193	$8.92	$4.25
First	2	5/9	6/30	52	15	1.04	23	.54	38	2.72	1.58
First	3	5/2	6/30	59	38	1.38	55	1.12	93	4.92	2.50
First	4	5/13	6/30	48	9	.79	107	2.86	116	5.84	3.65
First	5	4/28	6/30	63	53	1.59	160	3.05	213	9.72	4.64
First	8	5/26	6/30	35	51	2.78	137	4.71	188	8.72	7.49
Second	1	4/29	6/30	62	31	.90	77	1.50	108	5.52	2.40
Second	2	5/11	6/30	50	17	1.13	108	2.59	125	6.20	3.72
Second	3	4/29	6/30	62	31	.90	98	1.90	129	6.36	2.80
Second	4	5/1	6/30	60	18	.96	117	2.34	135	6.60	3.30
Second	5	4/28	6/30	63	43	1.39	119	2.27	162	7.68	3.66
Second	6	5/31	6/30	30	18	1.92	90	3.60	108	5.52	5.52
Second	7	5/24	6/30	37	74	3.37	26	.76	100	5.20	4.13
Second	8	4/29	6/30	62	78	2.10	159	3.08	237	10.68	5.18
Third	1	5/2	6/30	59	19	1.00	63	1.28	82	4.48	2.28
Third	3	5/1	6/30	60	22	1.04	265	5.30	287	12.68	6.34
Third	4	....	....	..	..	....	...	....	...	....	....
Third	5	5/16	6/30	45	10	.93	80	2.27	90	4.80	3.20
Third	6	5/1	6/30	60	11	.77	57	1.19	68	3.92	1.96
Third	7	5/13	6/30	48	22	1.30	44	1.11	66	3.84	2.41
Third	8	5/16	6/30	45	20	1.33	112	2.99	132	6.48	4.32
Fourth	1	5/2	6/30	59	9	.64	98	2.14	107	5.48	2.78
Fourth	4	4/28	6/30	63	25	1.05	171	3.26	196	9.04	4.31
Fourth	5	4/29	6/30	62	43	1.41	201	3.90	244	10.96	5.31
Fourth	6	4/29	6/30	62	22	1.00	168	3.25	190	8.80	4.25
Fourth	7	4/28	6/30	63	21	.97	99	1.89	120	6.00	2.86
Fourth	8	4/29	6/30	62	38	1.32	196	3.79	234	10.56	5.11
Basement	5	5/26	6/30	35	12	1.44	53	1.80	65	3.80	3.24
Basement	7	5/26	6/30	35	16	1.59	2	.06	18	1.92	1.65
Basement	Front	5/11	6/30	50	7	.59	69	1.96	76	4.24	2.55
Total	29	1554 days			799	$1.30	3121	$2.40	3920	$191.60	$3.70
Average		53.6 days			0.514 per day 15.42 per mo.		2 per day 60 per month		2.52 per day 75.6 per mo.	$0.123 per day $3.69 per month	

teresting facts. It is not apparent, for example, that more than one of the active users of the cooking service was extravagant in that service alone. In all cases but one where the total monthly bills were above $5, the energy used otherwise than in the range amounts to approximately 30 per cent of the total, whereas the average of the entire twenty-nine apartments shows that about 25 per cent, in round figures, was used for light and purposes other than cooking.

Another interesting fact is that, in 1554 range-days, the consumption averaged only 2 kw.-hr. per day, although this record was for the experimental period, when it is commonly expected that the consumption will be high, owing to the housewives' unfamiliarity with the electric stoves.

Electric Heating of Domestic Hot-Water Supply at Seattle, Wash.

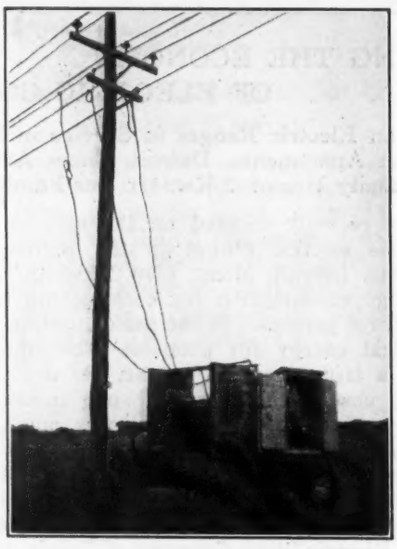
A special rate of ½ cent per kilowatt-hour for electric hot-water heaters in continuous service is now offered by the Seattle, Wash., municipal plant. This rate is the equivalent of a flat charge of $43.20 per kilowatt-year, or $3.60 per kilowatt-month. The electric heater is connected to the service lines ahead of the meter and the bill is made out according to the rating of the heater.

It has been found that a 600-watt or 750-watt heater running continuously will supply all the hot water needed in the average home at a cost of $2.15 to $2.70 per month. The privilege is given of disconnecting the heater during the winter, when hot water from the house heating system is available. The tank, usually 30 gal., is well lagged with heat insulation to prevent radiation loss. At the heating rate the cost of heating water electrically becomes considerably less even than the cost of operating a gas heater.

Electric cooking service is available from the lines of the Seattle plant at a cost of about 2 cents per kilowatt-hour, the rate for domestic service being 5½ cents for the first 45 kw.-hr. used per month, and 2 cents for each kilowatt-hour thereafter, with a monthly minimum of 50 cents. On this rate a large part of the cooking load is sold at 2 cents, which makes the cost of electric cooking compare very favorably with that of gas. Some 250 ranges are already connected to the city lines, and it is a significant fact that no customer who has tried electric cooking has yet shown any desire to go back to gas or coal. The average bill for current for electric cooking on 130 ranges was $3.05 a month. This bill included cost of current for a number of water heaters.

Kansas Farmers Do Threshing by Central Station Power

Nine progressive farmers along the transmission lines of the Riverside Light & Power Company of Abilene, Kansas, have organized themselves into the co-operative "Farmington Electric Threshing Association" for the purpose of purchasing equipment and doing their threshing electrically.



TRUCK CARRYING TRANSFORMER EQUIPMENT AND METER AND SWITCH CABINET

The central-station company, which operates about 150 miles of transmission line in Dickinson and adjoining counties, has been working for some time on a suitable plan for such a service, the advantages of which have finally been recognized by this group of farmers who have each subscribed a certain sum of money for the purchase of the up-to-date thresher. The power company furnishes all the electrical equipment for operating the thresher, ensilage cutter, or other machinery requiring more than 10 hp., and each farmer pays for the stub line leading from the transmission trunk-line to his field. These stub lines are built of light poles and iron wire and carry 6600 volts. The transformer, primary cut-out, meter and switches are mounted on a truck made from an ordinary farm wagon, and the pressure is stepped down to 440 volts for the 25-hp. squirrel-cage motor mounted with its starting compensator on a separate truck. The 500 ft. of cable connecting the trans-

THRESHING BY ELECTRICITY ON A KANSAS FARM. MOTOR AND STARTING COMPENSATOR ARE MOUNTED ON THE SMALL TRUCK SEEN AT THE RIGHT

THE HAY BALER IS ALSO MOTOR-DRIVEN. THE THRESHER AND BALING MACHINES ARE OWNED BY THE FARMERS' ASSOCIATION—THE MOTOR BELONGS TO THE ELECTRIC COMPANY

former wagon with the motor gives sufficient latitude for convenient location of motor and transformer.

The outfit is reported to be working very satisfactorily with a cost to the farmers of about one-half that charged by the steam thresher men. The association pays for the energy used at the flat rate of 5 cents per kw.-hr. and the energy consumption is about 250 watt hours per bushel, depending on the nature of the grain threshed. The revenue which the power company received from the nine farmers this year averages $17.50 for each threshing, and it is expected that the same electrical equipment will be used for filling silos, and will produce at least an equal amount of revenue. The farmers have also used the equipment for baling their hay, and the association is doing some threshing for their neighbors who happen to be located on the transmission lines, so that the total proceeds from the business will be well worth going after.

C. L. Brown, general manager of the power company, says of the plan: "While this experience is rather new in this country, our farmer friends are all delighted with the operation and the economy of the outfit. The probabilities are that next year a number of these outfits will be at work."

The Public Confidence Underlying Campaign Advertising and Selling

E. B. Atchley, publicity manager for the Kansas City Light & Power Company, in a talk before the Kansas City Advertising Club told of the methods by which the company had sold 1500 electric carpet sweepers and vacuum cleaners in six weeks, and 10,000 electric irons in less than a month. Mr. Atchley emphasized the point that the Kansas City public had been given reason to have confidence in the truth of the advertised statements of the company, and that the company in its distribution of cleaners and irons, was performing a real service to the public. Mr. Atchley said that for a year before the sale started the company had educated the public to the quality and uses of these particular $3.50 irons, telling them the good and the bad points about this iron, the truth from beginning to end. After making sure that the iron was fully worth $3.50—the company then bought 10,000 irons, and set a low price, $2, for the special sale. By the twenty-fifth day of the month all but a small reserve stock had been sold.

Mr. Atchley dwelt at length on the necessity for local advertising, particularly of electrical devices. National advertising, he said, is practically useless for direct sales without local advertising by a company or institution in which the local public has confidence.

An Objection to a High Primary Rate for Residence Service

D. L. Gaskill of Greenville, Ohio, speaking before a recent convention, said: "From a business and from a policy standpoint the high primary residential rate is wrong. It is nearly always the housewife who receives the electric-light bill. She can see very clearly the difference between 10 cents and 6 cents when that figure is applied to the top step of a lighting rate. What she cannot see is the difference a 6-cent rate made by a municipal plant would effect in the tax bill. She pays the electric-light bill herself, but the taxes, as a rule, are paid by the man of the house. This condition makes the woman particularly susceptible to the arguments of municipal-ownership advocates. It would seem, therefore, that the top step of a residence rate should be made as low as is consistent."

Wiring and Illumination

Latest Practice in the Electrical Contracting Field and in the Art of Interior and Exterior Illumination

The New Sign That Marks Salt Lake City's Electrically-Created Shopping Center

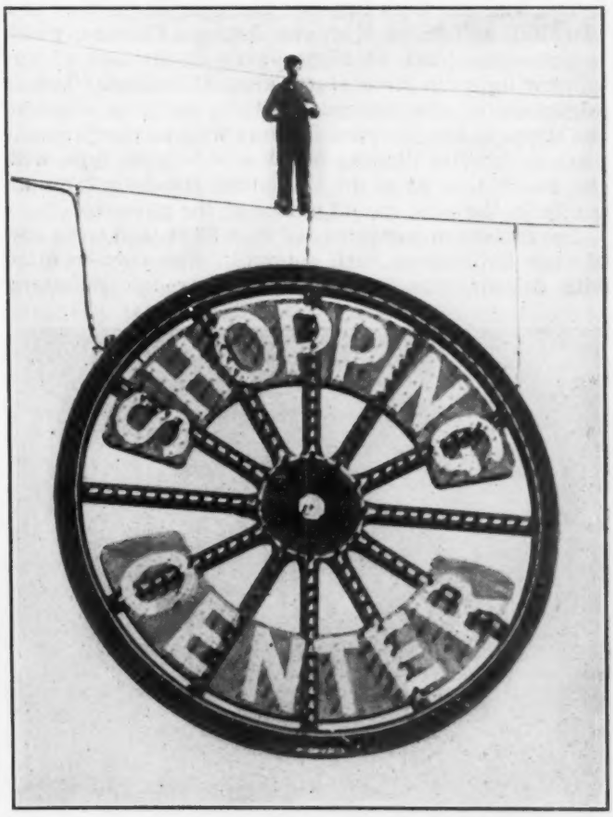
BY B. W. MENDENHALL

A huge new animated electric sign has been suspended over the intersection of Broadway and State Streets, Salt Lake City, Utah, by the State Street Improvement Association and the Broadway Improvement Association. Passersby who come within sight of this display by day or night have their attention forcibly called to this now-established shopping center which electric lighting helped to create a few years ago.

The great wheel is suspended 65 ft. above the 120-ft. street, but since the suspension cables run diagonally across the intersection, the distance between supports is 182 ft. The sign measures 19 ft. in diameter and weighs approximately 1200 lb. It is suspended by three stranded steel cables, two of them ¾ in. in diameter and a third one, a messenger cable, 5 ft. above these two, ½ in. in diameter. A flasher located in Auerbach's department store at one end of the messenger cable produces a rapid apparent rotation of the rim.

"TRADE FOLLOWS THE LIGHT"

The history of the shopping district marked by this sign is one of the strongest proofs which might be



THIS 19-FT. WHEEL IS SUSPENDED 65 FT. ABOVE THE STREET INTERSECTION WHICH MARKS THE NEW SHOPPING CENTER OF SALT LAKE CITY, CREATED BY ELECTRIC LIGHTING

offered that "trade follows the light." A few years ago this corner was quite outside of the shopping district and almost on the edge of the residence section of the city. Only a few small shops were located in its vicinity. Practically all of the retail business of the city was done on Main Street, and the then shopping center was two blocks away.

A Campaign of Light Artillery

About that time the firm of S. H. Auerbach & Brothers finally moved their department store to the new location—a step which many people declared that this would mean their elimination as an important factor in the retail trade. They also built a large structure on the corner opposite the one they themselves intended to occupy, and induced one of the other largest stores of the city, then located on Main Street, to lease it. The two stores moved and immediately began their campaign to pull trade to their new location. One of the principal agencies used was electric light. From the day of their openings these stores kept their windows, their fronts and the streets in their vicinity brilliantly lighted. As fast as more powerful and more efficient lamps were introduced these were immediately installed, with the result that in a very short time these stores had drawn their old trade over to the new location, and the intersection at which they were located became one of the busy corners of the city.

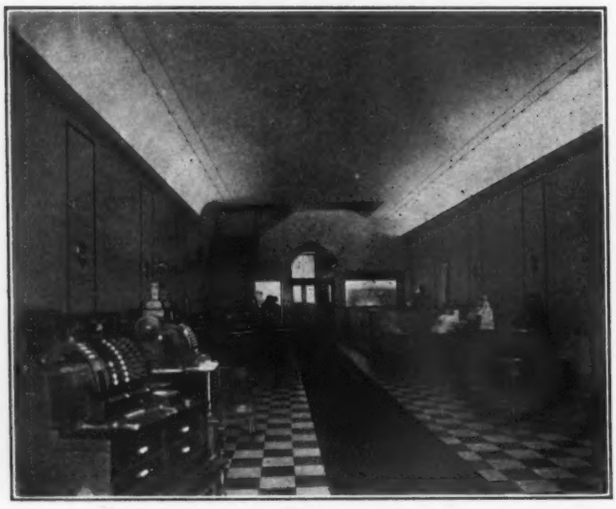
The sign was built and erected by the Inter-Mountain Electric Company of Salt Lake City.

COVE LIGHTING OF A STORE

Effective Illumination of a Chicago Salesroom Which Attracts Public Attention After Nightfall

The National Cash Register Company has a store in a two-block section of Michigan Avenue, Chicago, which is noticeably black at night owing to the lack of any window lights in other stores along the street. Taking advantage of the opportunity for a striking contrast, the company has equipped its store with an exceptionally pleasing interior lighting of the cove indirect type, with the result that at night this store stands out prominently in the most casual glance of the passerby.

The salesroom measures 100 ft. x 22 ft. and has a row of cove lighting on each sidewall. The cove is fitted with mirror type corrugated-glass trough reflectors, manufactured by the Blowman-Sollitt Company, and designed to reflect a large part of the light toward the center of the ceiling and to give a uniform distribution over the whole. The 25-watt Mazda lamps are spaced 10 in. between centers, and in all there are 115 of them, giving a total of 2.1 watts per square foot of floor space. This indirect lighting together with the French gray ceiling gives a particularly soft, mellow illumination, and eliminates all shadows. The arched corners at the ceiling also add to the beauty of the room. The Cuthbert Electric Manufacturing Company was the contractor for the work.



THIS SALESROOM, MEASURING 22 FT. BY 100 FT., IS LIGHTED BY 115 25-WATT LAMPS ON 10-IN. CENTERS, GIVING A TOTAL OF 2.1 WATTS PER SQUARE FOOT OF FLOOR SPACE

Experience with a Code Rule to Prevent the Overloading of Circuits—Chicago's Unique Requirement Based on Floor Area

BY V. H. TOUSLEY

Chief Electrical Inspector, Department of Gas and Electricity, Chicago.

Prior to the publication of the 1914 Electrical Code of the City of Chicago, the necessity for a rule to prevent overloading of circuits was felt by the electrical inspection bureau. Many building contractors were making a practice of wiring apartment buildings with one circuit per apartment, and after a certificate had been issued would increase the number of lamps and overload the circuits. One incident will serve to illustrate the methods followed. During the inspection of an apartment building the inspector was informed by the small child delegated to show him through the apartment that there were a lot of fixtures under one of the beds, which were to be put up after the inspector had completed his work.

To meet these conditions the 1914 edition of the Electrical Code of the City of Chicago contains the following requirements:

The "1 Watt per Square Foot" Rule

"23-d. Automatic cutouts (fuses and circuit breakers) must be so placed that no set of small motors, small heating devices or incandescent lamps, whether grouped on one fixture or on several fixtures or pendants (nor more than sixteen sockets or receptacles) requiring more than 660 watts, will be dependent upon one cutout.

"On new installations which are to be occupied as apartments, residences, offices or stores, a sufficient number of circuits must be provided to allow for at least 1 *watt per square foot of floor space,* the floor space to be determined by the total floor area, including partitions. For stores separate circuits must be provided for the show windows."

At the time this "1 watt per square foot" requirement was determined it was the understanding that it would be tried out for a period of two years, and then, if necessary, would be revised. When the last revision of the Chicago electrical code came up, an extended investigation of the results of this rule was made, both by the department of gas and electricity and by the lighting companies. As a result of this investigation the basis of the rule was changed to "¾ watt per square foot," or one circuit to each 880 sq. ft. The investigation made covered about 5000 completed installations.

It should be noted that the fundamental purpose of this rule is to provide a circuit rating sufficient to reduce to a minimum the liability of overloading circuits. If a consumer desires to increase the number of sockets on his circuits, he will probably do so by correspondingly reducing the current consumption of the lamps used in the fixtures. So far as is known, Chicago is the only city having a rule of this kind.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

WIRELESS TELEGRAPHY

The Mechanism of Transmission—Surface and Space Waves—The Effect of the Composition of the Atmosphere.

IN a paper presented before the Institute of Radio Engineers and published in the June, 1916, issue of its *Proceedings*, Fritz Lowenstein deals in an interesting manner with fundamental problems of the mechanism of radiation and propagation in radio communication. The intensity of the electric field at a distance from a statically-charged antenna is calculated from elementary considerations. The same quantity is derived for the case in which the charge is oscillating at a radio frequency. It is shown that the total charges acting on the receiver in the two cases have a ratio equal to the square of the ratio of the transmitting distance to a certain part of the wave length, and hence the great advantage of the radio frequency transmission.

The theories of Edison, Tesla and Sommerfeld are historically considered. It is shown that there is no physical justification for the separation of the wave into surface and space waves. The electric and magnetic intensities at various distances from the antenna are calculated, and it is shown that they become practically equal at a wave length away. The author prefers to regard radio transmission as due to conducted radio frequency earth currents rather than modified Hertzian oscillator waves. Or to quote him completely it seems to him more natural to speak of a conducted radio frequency current and to look upon the electric and magnetic field traveling with it as its accompanying result, than to designate radio transmission as identical with the radiation of a Hertzian oscillator modified by a conducting equatorial plane and by bending of radiation lines due to the earth's curvature and to the existence of the conducting upper strata.

FIG. 1—CHEMICAL COMPOSITION, PRESSURE AND TEMPERATURE OF THE ATMOSPHERE AT VARIOUS HEIGHTS

In the final part of the paper a very interesting summary is given of our knowledge of the composition of the atmosphere as it affects wireless telegraphy. Fig. 1 shows the chemical composition and pressure and the temperature of the atmosphere arranged for the varying heights.

Measurements of the intensity of light taken at sunset show three distinct discontinuities, when the last rays become tangent to layers of air at the height of 11 km., 75 km. and 220 km. In fact, test balloons with registering apparatus clearly show a very distinct change at the 11-km. height. The temperature which fell close to the earth at the rate of 5 deg. per kilometer, and at the height of 10 km. at the rate of 9 deg. per kilometer suddenly becomes constant in regions from 11 to 75 km., the mean temperature being minus 55 deg. C. A glance at the last curve of Fig. 1 will make this discontinuity very apparent. The reason for the uniformity of temperature may lie in the fact that the pressures to which the atmosphere is subjected at these altitudes are suited to electric conduction, as may be seen from inspection of the curve in the center of Fig. 1, wherein the pressures are given with their corresponding altitudes. This lower point of discontinuity (11 km.) has been further proven to exist by tests of chemical composition of the atmosphere.

As indicated in the curve to the left of Fig. 1, the volumetric analysis of the atmosphere as to its relative proportion of nitrogen and oxygen shows a constant proportion in this first layer of 11 km., the reason being that air currents rise and fall therein providing for thorough mixing and not permitting the two gases to arrange themselves according to their densities.

This lower layer of 11 km. in thickness, the troposphere, is shown in the diagram by a vertical line, denoting a constancy of mixture up to 11 km. Above that point, in the stratosphere, the two gases adjust themselves according to Dalton's law, the heavier oxygen losing and the lighter nitrogen gaining in relative proportion. At 60 km., the oxygen has practically disappeared, and the hydrogen becomes prominent. Because of the very great difference of density, however, the mixture of nitrogen and hydrogen extends over a comparatively thin layer of 15 km. only, and, as shown in the curve, there is a rather abrupt change from nitrogen to hydrogen at 75 km.

The third sudden change in light intensity at sundown occurs when the last sun rays pass tangent to a layer at a height of 220 km. Up to that moment the sky appeared blue by reason of the illumination of the hydrogen atoms, which are able to send the shorter rays of the sun's spectrum to our eyes. The sudden disappearance of blue is due to the rather sudden disappearance of hydrogen from the atmosphere, a stratum of coronium beginning at that height.

It remains to consider the bearing of these various changes on the transmission of electric energy through the space. The high pressures prevailing in the troposphere make it a perfect dielectric. The stratosphere is the layer of highest conductivity, bounded above by strata of such low pressures as to constitute practically dielectrics. Gradual changes of conductivity would entail considerable loss if they gave rise to marked reflections in electric wave propagation, and consequently a considerable amount of argument has been brought to bear against the possibility of efficient reflection by the upper strata. The abrupt changes shown to exist

in the atmosphere certainly permit us with less hesitancy to ascribe strong variations of received signal intensities (according to the wave length employed) to efficient reflection.

Generators, Motors and Transformers

Direct-Current Machines.—STANLEY PARKER SMITH.—Having discussed the principles underlying the design of direct-current machines, the author now applies these principles to the special case of the design of a high-speed direct-current generator with an output of 350 kw. at a constant terminal pressure of 500 volts and a speed of 200 r.p.m., with a temperature rise not exceeding 45 deg. C. after working continuously on full load. The method of procedure of the design is outlined and a numerical calculation is given.—London *Electrician*, July 7, 1916.

Design of Electromagnetic Machines.—STANLEY PARKER SMITH.—This is the second part of the article in which the author deals with the principles underlying the design of continuous-current machines and applies these principles to the design of a 350-kw., 500-volt generator running at 200 r.p.m. Consideration is given to proper design of armature slots, iron loss, resistance of armature winding, equalizing rings, commutator and brushgear, brushes and commutating poles.—London *Electrician*, July 14, 1916.

Correcting Power Factor.—An article which discusses the poor power factor that results when a large number of induction motors are working underloaded in steel rolling mills. The equipping of large induction motors with exciters or phase advancers, which supply magnetizing current to the motors, thus eliminating wattless current in the distributing system is outlined. These phase advancers can either be driven by the motors themselves, like an ordinary exciter, or by another motor or other driving agent. The armature is sometimes of the open-circuit type and sometimes of the closed-circuit type, depending upon the voltage and current conditions. The former winding is used when the current is great and the voltage to be generated by the phase advancer small, and the latter when the current is not so heavy and the voltage is higher. The Scherbius phase advancer made by Brown-Boveri is shown in Fig. 2. The

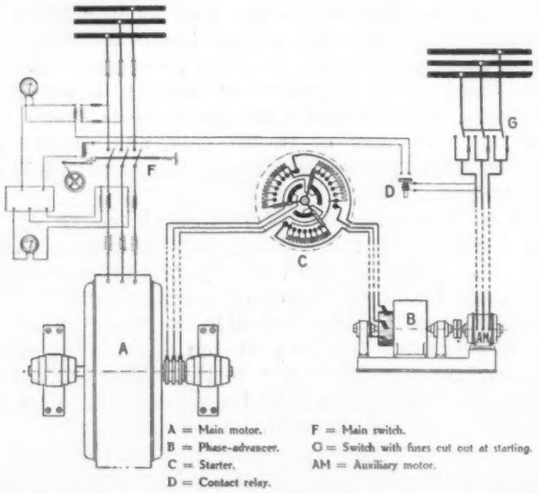


FIG. 2—CONNECTIONS FOR SCHERBIUS PHASE ADVANCER

armature is of the drum type, but the coils are embedded in a circle of slots well within the external diameter of the armature plates, so that the iron outside the slots serves as an external path for the flux which passes through the windings. This flux is, of course, produced by the combined action of the three rotor currents, and it revolves in space. If the phase advancer is stationary while the induction motor is at work, the former acts as a choking coil and causes a reactive drop and a lagging current. For a given current, this reactive drop depends only upon the frequency; that is, upon the rate at which the rotating field set up in the phase advancer cuts the winding. But if the rate of cutting is reduced by rotating the winding in the same direction as the field, the reactance—and therefore the lag—decreases, and finally, at synchronism, becomes zero. If the speed is increased above synchronism, the reactance attains a negative value, and the phase advancer acts as a capacity, with the result that the current is advanced. Since the current flowing in the armature of the advancer has a frequency proportional to the slip, viz., about 1 to 3 cycles, whereas the speed of rotation chosen for the phase advancer has a value corresponding to from 30 to 50 cycles, and a considerable leading current can therefore be produced. The power necessary for driving these phase advancers is very small, as only the friction of the machine has to be overcome. A phase connector for a 1000-hp. motor requires about 2 hp. to drive it.—London *Engineering*, July 14, 1916.

Generation, Transmission and Distribution

German Plan for Bulk Energy Supply.—Abstract of an address by Professor Klingenberg, president of the Society of German Electrical Engineers, in which the production of electricity on a large scale with government assistance was discussed. It was proposed that the government should erect a number of power stations on the largest possible scale at suitable sites distributing at 100,000 volts to transformer stations. The basis of the plan is to secure existing stations as customers for government stations, since any attempt at competition with existing stations would lead to failure. The capital invested in the existing stations in Germany amounted to $523,000,000 in 1913. By the investment of $215,000,000 in state power stations, provision could be made for a total output of current in bulk, by 1926, of 10,000,000,000 kw.-hr. The annual net profit on this bulk supply is estimated at $9,750,000. As this works out at something over 4.5 per cent, Dr. Klingenberg suggests taxation to make up the commercial balance. The most suitable forms are stated to be a direct tax on electricity and gas for lighting of 10 per cent on the invoiced amount, and an indirect tax on coal. On that basis the total revenue in 1926 from the sale of current and from taxes would be about $75,000,000. The calculated yield of the various taxes is set out as follows:

Taxes on electric light	$14,280,000
Taxes on gas light	3,808,000
Taxes on water power	714,000
Taxes on coal	4,760,000

Dr. Klingenberg's scheme as it stands is calculated to diminish the lighting peak, to discourage the use of gas, and to induce people to use electricity instead of coal. The only way to escape taxation will be to use current for industrial purposes.—*Electrical Industries*, July 12, 1916.

Electrophysics and Magnetism

The Low-Potential Discharge Spectrum of Mercury Vapor in Relation to Ionization Potentials.—JOHN T. TATE.—An abstract of an American Physical Society paper. A marked ionization occurs in mercury vapor when the velocity of the colliding electrons reaches a critical value of 10 volts. This is very nearly the value (10.2 volts) to be expected on the basis of Bohr's theory of the atom as McLennan has pointed out. The energy lost by the electrons at these collisions is radiated out as the many-lined spectrum of mercury. Although ionization of mercury vapor at 4.9 volts is not definitely disproved, it is certainly much less complete than the

ionization taking place at 10 volts.—*Phys. Review,* June, 1916.

Action of Calcium in a Discharge Tube.—H. B. C. ALLISON.—An abstract of an American Physical Society paper. During the course of some experiments on gaseous conduction, a number of Pluecker tubes containing various gases were made. The action of one of these tubes was considered worthy of note. The tube was of the usual type, having a capillary connecting the two electrode chambers, and was about 8 in. in length. The electrodes were aluminum rods mounted on platinum wires. In one of the electrode chambers some calcium chips were placed before the electrode was sealed into the tube. The usual lamp exhaust was given, and the tube filled with argon of at least 99.8 per cent purity. After washing out the tube twice it was sealed off at 2 mm. pressure and connected with a high-voltage transformer. A spectroscope having been put in position, the spectrum was observed to be a combination of argon lines and nitrogen bands, with four prominent hydrogen lines. As the tube continued to run the nitrogen disappeared first, and then the hydrogen, until only the pure argon spectrum remained. During this time the calcium chips were in the path of the discharge, but not in contact with the electrode. The tube was then inverted, and shortly the hydrogen lines appeared as brilliantly as at first. The calcium was then in contact with the electrode. Upon returning to the original position the clean-up of the hydrogen again took place. It was possible to repeat this reversal a large number of times, but as long as any calcium remained in contact with the electrode, hydrogen was always present in the spectrum. This is undoubtedly due to the formation of calcium hydride in the first position, and its subsequent decomposition when in contact with the electrode.—*Phys. Rev.,* June, 1916.

Conductivity of Flames.—C. W. HEAPS.—An account of an experimental investigation in which the potential gradient between vertical electrodes in a flame was studied in a series of cases, the cathode being covered with a deposit of metallic oxides for the production of electrons. The current-voltage curve indicates an apparent saturation current. This, however, is mainly due to the appearance of an anode fall of potential. Ionization by collision occurs for large values of the electric field. By measuring the effect of a magnetic field on the conductivity of the flame the velocity of the negative ions was determined, and k, the velocity under unit potential gradient, found to have a maximum value of 20,400 cm. per second. The value of k for a flame varies with X/p in much the same way as does k for air at ordinary temperatures, where p is the pressure in the gas and X is the electric intensity. The conclusion is drawn that when X/p is above 0.09 the flame ions are free electrons; when X/p varies from 0.09 to 0.01 (approximately) the free electrons begin to associate with gas molecules, and when X/p is below 0.01 the electrons are free only about one-eighth of the time. This variation of k with X/p probably explains the lack of agreement between the values of k as determined by different experimenters.—*Phys. Review,* June, 1916.

Installations, Systems and Appliances

Electricity in Small Households.—W. B. SMITH.—An illustrated paper read before the Greenock Electrical Society. The only hindrance to the universal adoption of electric lighting in small dwellings is the initial outlay required to fit up the installation. Curves are given showing the relation between average lighting bills and size of house; also the variation of lighting bills from month to month. Electric heating is discussed. "In the selection of an oven, top heat should be insisted on as well as bottom heat, as it enables the food to be well browned on top, and a better variation of the heat distribution in the oven is possible. Side elements are not so serviceable in this respect. The full temperature of 300 deg. or 400 deg. Fahr. should be attained in about twenty minutes after switching on, and the oven should be lagged so that about one-half the full loading maintains this temperature. The energy used for cooking varies from 1 to 1.5 kw.-hr. per day for each person." Figures of cost for lighting and cooking are given under different conditions.—London *Elec. Review,* June 23, 1916.

Control Gear.—E. F. BUTLER.—An illustrated article giving many practical hints on details of construction of direct-current motor starters and control gears in general.—London *Elec. Review,* June 23 and 30, 1916.

Breakdowns of Electrical Machinery.—C. S. BUYERS.—An abstract of a paper read before the Scientific Society of the Royal Technical College of Glasgow on the causes of breakdowns. With regard to faulty manufacture the necessity for ample clearance between the rotor of an induction motor and the stator is pointed out. In steel works with overhead wires it is stated that during thunderstorms it is advisable to shut down the electric plant, as lightning arresters are unreliable, the busbars being connected to earth. It is considered a wise plan to run direct-current machinery at 10 to 20 per cent below full load, as the wear and tear is then considerably reduced. With induction motors, however, these should be run at approximately full load. The various types of dirts which cause breakdowns are given as moisture, oil, carbon dust, metal, chips, filings or turnings, sawdust, wool or cotton fluff, cement and coal dust, and acids, chemical fumes and exhaust gases. The effect of moisture on insulators, such as presspahn, is next discussed, and the necessity for dryness in such cases indicated. This is particularly important in shipyards, collieries and iron works where motors work in exposed positions. A too liberal use of oil is considered as likely to cause trouble, and a case is referred to where the bearings were lubricated three times a day, and the overflow being plugged up a breakdown quickly ensued in the armature coils and two bottom field coils of the motor. To prevent overfilling of the bearings a snag should be cast on the outside of the bearing housing at the proper oil level. This should be filled with a small hinged lid and have a 0.75-in. diameter hole to prevent it getting easily choked with dirt. Air filters, dry and wet, are dealt with, and the use is recommended of a small blower for cleaning. The trouble caused by ventilating fans drawing dust into inclosed motors is referred to; open motors without fans in such cases are to be preferred. In order to prevent fine particles of copper flying off from the tools and getting on to the commutator lugs when truing the commutator, it is advisable to cut a piece of millboard the same diameter as the armature coil. A circular hole the same diameter as the commutator is then cut in it, and it is pushed tightly up against the front of the lugs. After turning the main segments should be carefully examined and any copper particles removed; the windings should also be blown through with compressed air or by a pair of bellows. With regard to bearings, the oil should be renewed and the sludge in the oil chamber cleared out. The life of an open-type motor in a sulphuric acid factory is stated to be a very short one, and the author recommends totally-inclosed motors with tightly-fitting doors closed by sheds and wing nets. The armature windings and field coils should receive three coats of anti-sulphuric enamel. Other exposed parts should receive one coat. Alternating-current motors should be treated similarly, and switches should preferably be inclosed in a wooden case with glass front and operated from outside.—London *Electrician,* June 30, 1916.

Readers' Views and Comments

Economy of Small Non-Condensing Turbines

To the Editor of ELECTRICAL WORLD:

Sir:—The comment on small turbine economies published on page 58 of the July 8 issue of the ELECTRICAL WORLD in connection with the operation of the geared turbine installations at Dowagiac, Mich., and at Hoopeston, Ill., seems to the writer somewhat unfair, since the non-condensing plant is not given due credit for its actual performance.

Special attention is called to the paragraph in which it is said, "As everybody knows, running a turbine non-condensing is like shoveling coal into the river, and it is not surprising to find this plant, for which full-load steam consumption of 38+ lb. was guaranteed, requiring 9 lb. of coal per kilowatt-hour in its actual operation."

By referring to the economy guarantees published in the article mentioned, it is seen that the actual economy obtained on the Hoopeston turbine was about 36.5 lb. per kilowatt-hour, which is really quite a remarkable result for so small a non-condensing turbine. This economy corresponds to a Rankine cycle efficiency of a little more than 61 per cent on the brake-horsepower basis, and would mean that a reciprocating engine would have to do approximately 67 per cent Rankine cycle efficiency on the indicated water rate basis.

A Rankine cycle efficiency of 61 per cent on the brake-horsepower basis with a machine which will give this performance in the hands of any operator, who, in order to keep the machine operating, has nothing to do but keep the oil clean, certainly compares very favorably with any type of reciprocating engine, which requires more or less expert operation and expert adjustment from time to time in order to maintain anywhere near its test economy. It is well known that practically every reciprocating engine plant suffers in economy due to the changes in valve setting which are made from time to time. This occurs every time there is a change of operating engineers, for each operating engineer has his own ideas in regard to the valve setting which will give the best economy. Similar circumstances cannot exist with the turbine, however, for the only thing the engineer can do is to turn on the steam. The turbine will then give the same performance in practice as it does on test.

This latter statement is borne out by the fact that, as given on page 68 of the article on the plants referred to, it was stated as follows: "At the latter station the guaranteed water rate for 37.5 kw. at 125 lb. pressure is 40 lb. per kilowatt-hour, whereas the average consumption during one month's operation was actually 32.019 lb. steam per kilowatt-hour, with an average load of 37 kw." The economy of this turbine obtained on test showed a steam consumption of 32.3 lb. per kilowatt hour at a load of 37 kw. with 150 lb. steam pressure and 28 in. of vacuum. In other words, according to the data actually obtained in the operation of this plant, the economy for a whole month averaged somewhat better than that determined on the test floor under somewhat more favorable conditions. The explanation is that the slightly higher water rate obtained on test was undoubtedly due to the inaccuracy of weighing the steam condensed during the test period of only one hour's duration.

It is hardly fair to say that the operation of a turbine non-condensing is like throwing coal into the river for the simple reason that in most plants that are operated non-condensing the exhaust steam is used either in some manufacturing process or for heating during at least six months, and even possibly seven months of the year. Consequently, in most cases it might be said that the power is obtained free of charge, as the steam required for the industrial process or heating system would have to be furnished by live steam from which there would be no return. The operation of plants non-condensing, even where the heating season is only five or six months, is frequently justified by the fact that water for condensing purposes is scarce, and in a small plant the interest on the investment of a cooling pond, spraying apparatus, condensers and auxiliaries does not justify the saving which could be obtained by their use during the few months when the exhaust steam is not being usefully employed.

It is true that American plants are backward in the use of superheated steam and higher steam pressure, as steam at 200 lb. or even 250 lb. pressure with 50 to 100 deg. Fahr. superheat can be generated almost as cheaply as saturated steam at 100 lb., whereas there would be a great difference in the steam consumption of turbines operating under these conditions. The investment in superheaters and boilers designed for higher pressure would be well warranted in any plant operating non-condensing except in those where all the exhaust steam is used in some manufacturing process during the entire year. Even in those plants where the exhaust steam can be utilized for a few months only, superheating and higher pressure should be employed. The point under discussion, however, is that under the conditions of operation at Hoopeston, Ill., the performance is really remarkable and does not justify the remark about throwing coal into the river, nor should it "serve as a scarecrow to warn against working a perfectly respectable and well-intentioned turbine non-condensing."

In regard to the operation of the Dowagiac plant and the performance of 3.88 lb. of coal per kilowatt-hour operation for a load of only 37 kw., it may be only just to point out that while this coal consumption will obtain with the turbine water rate of 32.019 lb. per kilowatt hour, the steam consumption at full load shown by the test was something under 21.5 lb. per kilowatt-hour, and with this water rate the coal consumption of the plant should not be more than approximately 2.6 lb. of coal per kilowatt-hour.

Bearing in mind that the Dowagiac plant has only 150 kw. normal rated capacity, it would compare remarkably well with the 1.68 lb. of coal per kilowatt-hour obtained at the Seventy-fourth Street plant of the Interborough Rapid Transit Company in New York City, which is equipped with 30,000-kw turbines and has every means of saving the heat lost from the generators, bearings, oil coolers, etc., to the boilers, which equipment the smaller plant does not have.

D. O. TYLEE.

Westinghouse Electric & Manufacturing Company.

East Pittsburgh, Pa.

Elimination of Belt Insulation on Multiple Conductor Cables

To the Editor of ELECTRICAL WORLD:

Sir:—Under date of June 17, pages 1427-28, an abstract of an interesting German paper by Mr. Hoechstaedter was published in the ELECTRICAL WORLD, in which the use of a metallic covering over the insulation on each conductor of a three-phase cable and the elimination of the belt insulation is recommended. The writer for a number of years has been recommending the elimination of belt insulation on all multiple conductor cables, except where required for mechanical reasons, as it is practically impossible to make any electrical test that will discover defects in it.

The use of a metallic covering over the insulation on each of the conductors of a three-phase cable was suggested by the writer to the engineers of the New York Central, and under date of May 25, 1914, the company with which the writer is connected, at his suggestion, wrote the New York Central offering to build cables for a certain special location on their 11,000-volt lines made up as follows:

> Three-conductor No. AWG 19 strands, each conductor insulated with 9/32-in. wall of Okonite insulation, taped, special metallic covering, the three conductors assembled in cable form, jute filled, one tape one-third lap and two braids over all; outside diameter 2¾ in.
>
> Three-conductor No. 4/0 AWG 19 strands, each conductor insulated with 9/32-in. wall of Okonite insulation, special metallic covering, the three conductors assembled in cable form, jute filled, one layer of dry jute, two layers flat steel tape, one layer of jute saturated; outside diameter 3⅛ in.

These cables differ in design from Mr. Hoechstaedter's only in that they are insulated with rubber instead of paper and have no lead sheath, so that the idea is not original with Mr. Hoechstaedter. The armor on the second cable was intended for mechanical protection in the absence of conduit.

The writer feels that this type of cable will prove superior to the present generally accepted type and will come into more general use as its advantages are recognized by operating engineers.

FRANCIS J. WHITE.

New York City.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

W. C. L. EGLIN

William C. L. Eglin, who has been appointed chairman of the new committee on safety rules and accident prevention of the National Electric Light Association, which will work with the National Bureau of Standards, is a past-president of the National Electric Light Association and second vice-president of the Philadelphia Electric Company. Mr. Eglin is a native of Glasgow, Scotland, and received his scholastic training at the Andersonian University of that city and at the West of Scotland Technological College. Following graduation he assisted Rankin Kennedy in his early experimental work on alternating-current generators and transformers, and in 1889 came to the United States, where he joined the Edison Electric Light Company of Philadelphia. Later he was appointed engineer in charge of the electrical department of the Philadelphia company. He continued in this position until the consolidation of the Edison company with the Penn Heat, Light & Power Company in 1896, shortly after which he was appointed electrical engineer for the Philadelphia Electric company. Besides his work as chief executive officer in charge of the company's engineering and operating departments, Mr. Eglin has taken an active part in all matters relating to the company's progress, and has given particular attention to the various educational and beneficial organizations within the ranks of the employees. Mr. Eglin has also contributed to the proceedings of the Association of Edison Illuminating Companies and of the American Institute of Electrical Engineers, which latter he has served both as a manager and as vice-president. In the National Electric Light Association he has occupied successively the offices of secretary and treasurer, second vice-president, and president. During his term as president (1908-1909) the association made great strides in activity, the membership being more than doubled.

MacAllister Moore, formerly Canadian representative of the Simplex Electric Heating Company, has joined the sales force of the National Electric Utilities Corporation, New York City.

M. K. Foxworthy has been appointed manager of the Danville (Ind.) Light, Heat & Power Company.

H. S. Beidelman of 2343 Broadway, New York City, is the new secretary of the Associated Electrical Contractors of New York City, succeeding H. M. Walter, who recently resigned.

L. S. Montgomery, district manager in charge of the Buffalo office of the National Metal Molding Company of Pittsburgh, and Past Apollo in the Jovian Order, is now on the Mexican border with Troop I, First Cavalry, New York State National Guard.

W. L. Frost has been transferred from the Redlands district of the Southern California Edison Company to the company's general offices at Los Angeles, Cal., where he becomes assistant to the general agent, succeeding J. H. Pieper, whose death was recently announced in these columns.

Marvin W. Foss has been appointed manager of the Berlin (N. H.) Electric Light & Power Company. Mr. Foss was formerly employed by the Leominster Electric Light & Power Company, one of the properties controlled by the Tri-State Electric Light & Power Company, which operates the Berlin plant.

James R. Strong, president of the Tucker Electric Construction Company of New York City, and a past-president of the National Electrical Contractors' Association, left New York on Aug. 10 for a pleasure trip to Alaska by way of Vancouver (B. C.) and Skaguay. Mr. Strong is taking a vacation accompanied by his wife and family. The party plans to start on Sept. 13 on the return journey by way of Canada.

Alfred F. Townsend, for the last seven years manager of the Woonsocket (Mass.) division of the Blackstone Valley Gas & Electric Company, a Stone & Webster corporation, has been appointed manager of the Eastern Texas Electric Company, which operates a group of properties in Beaumont and Port Arthur, Tex. Mr. Townsend recently returned to Woonsocket after a three months' stay at Ponce, Porto Rico, where he served as manager of the local Stone & Webster interests during the illness of Manager Prentiss M. Hatch. Before coming to Woonsocket Mr. Townsend was for five years manager of the Capron Electric Company and vice-president of the Sidney (Nova Scotia) & Glace Railway Company. Prior to his experience in Nova Scotia Mr. Townsend served two years with the Ponce Railway & Light Company in Porto Rico, and was for a time with the Lowell (Mass.) Electric Light corporation.

DR. E. P. HYDE

Dr. Edward P. Hyde, who is chairman of the committee on lectures for the Illuminating Engineering Society's lecture course to be held at the University of Pennsylvania, Philadelphia, from Sept. 21 to 28, is the director of the physical laboratory of the National Lamp interests, Nela Park, Cleveland, Ohio. Dr. Hyde is a graduate of Johns Hopkins University, from which he also obtained his Ph.D. degree in 1904. For eight years Dr. Hyde was connected with the National Bureau of Standards at Washington, devoting much of his attention to the photometry of incandescent lamps, and supervising, incidentally, the design and installation of the bureau's new photometric laboratory. In 1905 he visited a number of European laboratories on behalf of the bureau to investigate photometric methods abroad, but in 1908 he resigned as associate physicist of the bureau in order to take charge of the new physics laboratory of the associated lamp interests at Cleveland. Dr. Hyde is a charter member of the Illuminating Engineering Society, and served as its president in 1910.

J. G. Monahan, who was until recently Western manager of the Ferranti Electric Company of Canada, has been appointed Los Angeles district manager for the Sangamo Electric Company.

T. H. Soren, for twenty-three years connected with the Schenectady (N. Y.) works of the General Electric Company, has been appointed assistant to Samuel Ferguson, vice-president of the Hartford Electric Light Company.

Obituary

Philip Henry Clarke, manager of the Union Light & Power Company, Franklin, Mass., was killed Aug. 10, in a collision between a New Haven Railroad train and an automobile in which he was riding, at White's Crossing, a short distance from Bellingham Center. Mr. Clarke was thirty-five years of age. Ernest L. Brown of Wakefield, Mass., an engineer in the meter department of the General Electric Company's Boston office, was injured in the collision.

NEW APPARATUS AND APPLIANCES

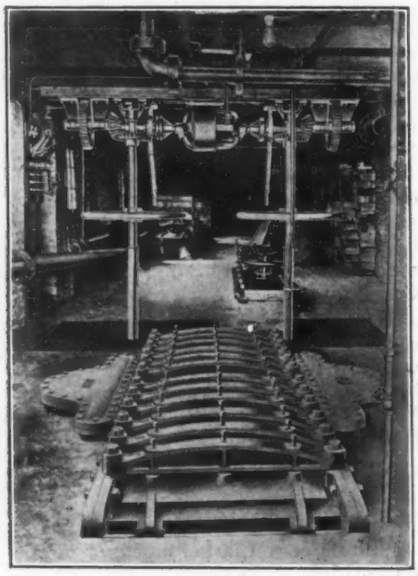
A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Water Strainer with Motor-Drive Attachment

What is said to be one of the largest twin strainers ever built has recently been made by the Elliot Company, Pittsburgh, Pa., for the Toledo Railways & Light Company. The apparatus is of particular interest because of the motor-drive attachment, by means of which the valves are operated so as to direct the flow of water through either compartment of the strainer.

The strainer is installed in the suction line to the condenser of a 20,000-kva. turbine installation. It is designed to catch and retain in the strainer baskets all such solid particles as leaves, fish, etc., that may be drawn into the intake line with the circulating water for the condenser. When the baskets in one side of the strainer are in service the baskets in the other side may be removed from the strainer, carried to a convenient place and cleaned. They are then put back in place in the strainer, and when the baskets then in service become foul with the solid matter taken out of the water passing through the strainer the clean baskets can be put in service by simply shifting the two flanges of the strainer.

An interesting feature in connection



LARGE-SIZED TWIN STRAINER WITH OVERHEAD MOTOR DRIVE

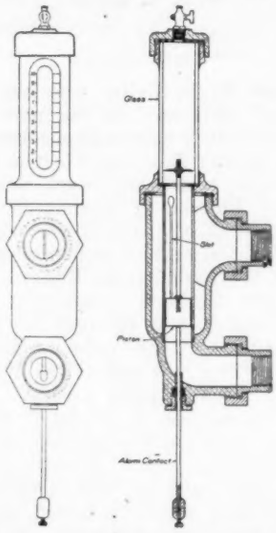
with the installation is the fact that the motor and operating mechanism are placed overhead, as shown. This was done for the reason that the strainer is likely to be submerged during the flood season and if the motor were attached directly to the strainer it would be damaged by the water. With the motor attached to the ceiling overhead, as shown in the accompanying illustration, the strainer can be completely submerged but the motor will still be high and dry. After the motor is started and brought up to full speed, the clutch controlling one of the valves is thrown in and the valve is moved from its seat. The clutch is then thrown out and the other clutch thrown in. When both valves have been moved from their seats both clutches are held in engagement until the valves have been moved across the strainer almost to a seating position at the other side. Both clutches are then thrown out of engagement and the valves are "teased" onto their seats one at a time. To move the valves back again the direction of rotation of the motor is reversed and the operation is just the reverse of that described above.

The controlling apparatus furnished with the motor for the motor-operated twin strainers is complete, and consists of a reversing switch, indicating lamps and an overload relay, all of which are shown mounted on the panel appearing at the left in the illustration. The overload relay is used to break the circuit should the operator fail to throw the clutches out of engagement when the valves come to the end of their travel. This is really a safety measure, as indicators are provided on the valve stems so that the operator can see the exact position of the valves. The indicating lamps are simply to show whether the valves are moving toward the right or toward the left.

Flow Meter

An instrument which has been designed and patented by J. F. Vaughn, and which is being placed on the market by the Spray Engineering Company, 93 Federal Street, Boston, Mass., has been developed to meet the demand for a simple and efficient method of indicating the flow of liquids in pipes. It is applicable to a large number of commercial systems, such as for cooling, heating, lubricating, refrigerating, boiler supply and various other manufacturing processes. As shown in the illustration, the instrument consists of a cylindrical chamber with suitable pipe connections inclosing a slotted tube through which the liquid must pass. Inclosed in the slotted tube is a piston which, as the liquid is turned on, is carried up until the exposed area of the slots is sufficient to allow the flow of the liquid up to the capacity of the indicator. An index is attached to the upper end of the piston rod, which extends up into a glass tube at the top of the cylindrical chamber. The glass tube is incased in a protecting cover, cut away to allow the movement of the index, corresponding to the rise or fall of the piston, to be noted. A scale on the side of the case enables the operator to determine accurately the amount of flow in gallons per minute.

An electric contact consisting of an



DIAGRAMMATIC VIEWS OF FLOW METER

adjustable brass rod set through an insulated stuffing box at the bottom of the chamber can be connected to a lamp or bell, calling attention when the flow has fallen below a fixed minimum. Contact is established immediately the piston rests on the brass rod. The desired flow of the liquid may thus be secured within the capacity of the instrument. The flow is directly proportional to the area of the slots in the inclosed tube, or to the rise or fall of the piston.

Under test the indicator gives practically a straight line calibration over a large range, and the loss of head in operating the instrument has been found to be negligible, not exceeding 0.004 lb. per square inch with a capacity of 15 gal. per minute. The indicator may be used with screens for dirty water, and can readily be cleaned by unscrewing the top and slipping out the slotted tube and glass.

Simple Electric Range

A firm belief in electric ranges of the utmost simplicity has prompted the Globe Stove & Range Company of Kokomo, Ind., to develop a new model of its large double-oven type of electric range. The most important change is the elimination of the thermostat. The main switch and pilot light have also been discarded, and the parts of the stove demanding constant use and at-

tention by the housewife have been reduced thereby. A push-button controlling the two lamp-socket receptacles and tubular lamp has been placed in an advantageous location. Anchor connections in the rear allow the two castings

DOUBLE-OVEN ELECTRIC RANGE

comprising the top of the stove to be raised and lowered at will for inspection and repairs. The new base casting and legs give a finish and pleasing appearance to this new model which are borne out by various other refinements.

Electric-Sign Bulletin

The "Electrograph" is a new equipment communicating any desired message to a crowd of people, inside of buildings, halls or in the open air. This is done by means of electric light flashes on a field or bank of electric lamps, certain groups of lamps being lighted momentarily to form letters of a word or words, which in succession are visible and form the sentence desired. The device is a development of the electric sign flasher, employing a similar principle of operation, but being more compact and adaptable to a large number of uses. The apparatus is being made in various sizes and styles, from the small window display attraction up to the largest open-air or roof sign. The machinery controlling the device, being light and small, requires but little floor space and can be placed anywhere near the lamp-letter-field or lamp-bank, and may be concealed in various manners.

The text or message to be transmitted or communicated is first prepared in form of a stencil or record and then inserted in the machine. The preparation of the record is simple and easy. It is made with a special perforator for this purpose and permits unlimited variation of the reading matter according to need and occasion.

The outfit consists of the following essential parts: (A) Lamp-letter-field or lamp-bank; (B) flash controller for stencils or record; (C) connecting cable between A and B.

The smaller lamp-banks are built on a so-called single-spot system, each lamp being separately controlled by its individual wire. In the case of very large frames or banks, either large lamps are used, or preferably two or four lamps are grouped closely together and connected as a unit so that the group is lighted and extinguished by one control. This is the multiple-spot system; it does not change the other elements of the system in their relation to each other, but merely increases the number of lamps to twice or four times the number on the single-spot plan, and consequently increases the lighting and advertising effect to the same extent.

The smaller sizes of lamp-banks are arranged for low-voltage lamps (2 volts to 10 volts and various candle powers), the medium sizes for 20-volt to 32-volt lamps, and the larger banks for standard 110-volt lamps.

The number of lamps in a bank may be of unlimited variation. In order to simplify the system a minimum standard has been adopted of 490 to 560 lamps, *i.e.*, seven rows of seventy lamps or seven rows of eighty, one having sufficient room to produce words with twelve to fourteen letters or less, the other fourteen to sixteen letters to the word or phrase as maximum. The number of rows of lamps in the vertical sense may be nine or eleven, preferably for larger letters, as it will produce a better effect for long-distance reading.

One controller may operate two or more separate lamp-banks in different locations simultaneously. Thus, one controller can operate a small bank or sign in the show window and at the same time a larger bank on the front of the building or on the roof. The flash controller is a simple rugged machine that can be operated on any electric circuit. It is driven by a small motor, either direct-current or alternating-current (110 volts or 220 volts), as the case may be; the machine may be controlled by a time switch to eliminate the need for hand starting and stopping. The periods of flash and rest are adjustable to the proper value, and the speed can be set to whatever is desired. Control is either mechanical or electro-mechanical, according to the size of the lamp-bank and number of lamps used and the number of banks controlled by one machine.

The apparatus is being made by the Electrograph Company, 53 Jackson Boulevard, Chicago.

Outdoor Electric Sign

The Flashtric Sign Works, 215 South Clinton Street, Chicago, Ill., has recently placed on the market an electric sign of low price which it intends to produce in large numbers. The sign is 9 ft. long, 3 ft. wide and 1 ft. thick, and is provided with one row of illuminated 14-in. letters on each side. Any wording of from three to twelve letters on each side can be obtained. Use is made of white letters on a black background. The sign is equipped with three 100-watt nitrogen-filled lamps. Main chain, guy chains, turnbuckle, shoes, expansion bolts, etc., are also provided so that the sign may be placed in position in less than two hours, the maker claims, by an ordinary mechanic and a helper.

Spring Toggle

The United States Expansion Bolt Company, Elm and Duane Streets, New York, has developed an "Arrow" spring toggle, as it is called, which is attached to a threaded rod and is provided with wings which fold together for insertion in a hole, but through the action of the spring tend to spread. After the bolt threads its way through the trunnion nut the wings of the spring toggle bear directly upon the threads of the bolt, thus supplying a double grip. The lock-nut principle obviates loosening of fixtures, for when the toggle is tightened into place, the double-grip action is the same as that of a lock nut. The sharp corners of the toggle head grip the inner wall surface, prevent turning and insure instant bearing and purchase, it is declared. The device is adapted for work in shallow hollows because the toggle wings are only 1 in. long. It will also hold in corners with only one wing opened, because each wing bears individually and directly upon the threads of the bolt. The toggle is being made in ⅛-in., 3/16-in. and ¼-in. sizes and the rod may be provided with a round head or flat head.

Incandescent Lamp with Fusible Resistor

A simple means for completing the circuit of an incandescent lamp when the filament breaks (especially for use when two or more lamps are in series) has been devised by George F. Heustis, Malden, Mass. Instead of a fusible resistor in the fixture to which the lamp is attached, the lamp stem is provided with a rigid v-shaped metal arm, one end of which is provided with a plate mounted on the end of the lamp stem, and connected to one end of the filament, and the other end of which is provided with a similar plate, which is held in position parallel to the first-named plate and at a short distance therefrom, both plates being held in planes at right angles to the longitudinal central line of the lamp stem. A cut-out spring is mounted on the end of the lamp neck and soldered to the

FUSIBLE RESISTOR ATTACHED TO LAMP STEM

side terminal. The spring is normally held out of electrical contact with one of the plates by a fusible resistance disk called the "film cut-out." When the lamp is screwed into the socket the plate to which the fusible disk is attached comes into contact with an arm attached to the socket, so that the current will pass through the lamp filament in the ordinary manner. In case the filament breaks, the disk becomes fused, the spring comes into contact with the plate to which the disk is attached, cutting out the filament and restoring the lamp circuit. The renewal of the fusible resistor is accomplished, therefore, by merely renewing the lamp.

Family-Size Electric Washer

Under the name of the "Geyser," the Capital Electric Company, 321 North Sheldon Street, Chicago, Ill., is marketing a new cylinder-type washer with an all-metal tank and frame, electrically welded. The cylinder, which is removable, is of triple-plated metal and is easy to keep clean and sanitary. Due to the absence of chains, bolts and gears the cylinder is easily removable, thus making it possible to keep the washer tank clean without great effort. The wringer is reversible, has a safety release, and can be used at the same time as the washer or independently. A 0.25-hp. Westinghouse motor operates both the washer and wringer. Levers on the top edge of the washer control both the washer and wringer, and a snap switch is provided for turning on current. By the method employed in the "Geyser" machine, it is pointed out, the clothes are always completely under

MOTOR-DRIVEN WASHER WITH ALL-METAL TANK AND FRAME

water in a cylinder free to revolve, and a powerful circulation of hot suds is forced through them. Thus, as the clothes are not stirred around and lifted out of the water they do not become matted together and are not strained or torn by rubbing or plunging. The washer is small but roomy. The one illustrated, known as the family size, has a capacity of six sheets. A home laundry size is made having a capacity of nine sheets, and a smaller one for light washing called the "Baby Geyser," which is only 14 in. wide but has a capacity of three sheets. It is admirably suited for use in bathroom or kitchen.

Speed-Control System for Traction Motors

A speed-control system for traction motors which permits the whole storage battery to be connected in series, a constant potential being thus provided to the motor, has been developed by J. E. Haschke, 843 West Sixty-sixth Street,

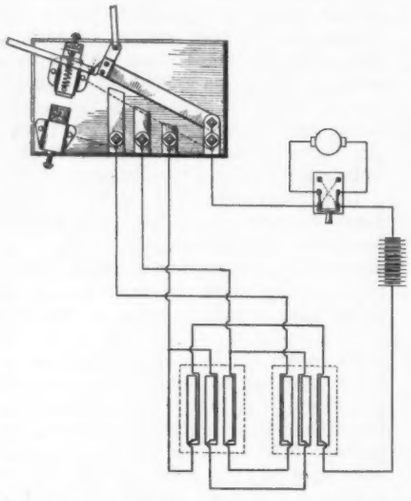


DIAGRAM OF CONNECTIONS FOR NON-RESISTANCE SPEED-CONTROL SYSTEM

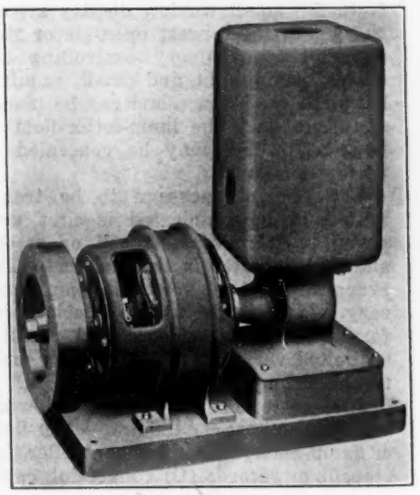
Los Angeles, Cal. By means of this system, it is pointed out, the battery can always be charged as it is discharged, that is, in series. As shown in the accompanying illustration, the motor is connected through a double-throw switch in series with the battery through the controller and through the field windings of the motor.

The controller is provided with a switch arm which is so placed that it will engage contact members at different points in its rotation, the arm remaining in contact with each contact member after it comes in contact with the succeeding one. Extending from the switch arm is an attachment for preventing arcing. The illustration shows a motor with two poles and the coils connected for a three-speed system; however, provision can be made for any number of poles and speeds.

In operation, when it is desired to impel the motor in either direction, the double-throw switch is thrown in the direction desired, and the switch arm moved in the direction of the contact members, first making connection with the non-arcing attachment and approximately at the same time making connection with the longest contact member, whereupon a circuit is closed from one side of the battery through the circuit indicated to the other side of the battery. By moving the arm further in the direction of the contact blades until connection is made with the arm and the contact member next in size two coils previously in circuit are short-circuited. Similarly, further movement of the arm short-circuits other coils. Thus corresponding sections of each of the pole windings are short-circuited by moving the switch arm, and the current which flows through the coil windings and through the armature of the motor is thus varied according to the movement of the switch arm, resulting in a corresponding change of speed for each different position of the arm.

Small Lighting Set

In the accompanying illustration is shown a new house-lighting unit placed on the market by the Swartz Electric Company of Indianapolis, Ind. The outfit is being made with ratings of 0.75 kw. and 1.5 kw. and for pressures of 32 volts and 64 volts. It may also be of semi-automatic or full-automatic design. In the latter-named type a differentially compounded solenoid operates the starting switch so that the storage battery is kept at nearly a constant charge. With this type it is merely necessary to press the wall button and if the energy consumption is sufficiently large or the voltage of the battery low, the solenoid will operate the switch and so automatically start the engine. It then becomes merely necessary to keep the engine and bearings properly supplied with oil, gasoline and water. The unit is equipped with Edison batteries. Control of speed and voltage is accomplished by a device which is a modification of the Tyrrill regulator, which maintains the voltage constant with a fraction of 1 per cent. All shafts run in ball bearings and the flywheel is a drop forging. The maker claims for



SELF-CONTAINED LIGHTING OUTFIT

the generator an efficiency of 85 per cent and that with gasoline at 15 cents per gallon energy can be generated at a total cost of 4 cents per kw., including interest, depreciation, etc.

NEWS OF THE INDUSTRY

A Review of Activities in the Electrical Manufacturing, Selling and Central-Station Fields

INDUSTRIAL PATRIOTISM AT SCHENECTADY WORKS

Employees of General Electric Company Decorate Workshops and Office Buildings With National Emblem

Industrial patriotism is most significant when it shows a mutual spirit in employer and employee. An example of this kind of patriotism may be found among the working forces of the main plant of the General Electric Company at Schenectady, N. Y. It is here that more than 20,000 employees of the great electrical manufacturing plant have contributed freely from their pay envelopes to buy an American flag for nearly every workshop and office building on the company's property. More than a score of flags, most of them large enough to make a carpet for the average size living room, now fly from buildings all over the works. Innumerable smaller flags, purchased by individuals, are seen everywhere, in doors, windows, on walls, and even suspended from giant machines and traveling cranes.

The patriotic feeling of the employees was first aroused last June when they took a great part in the preparedness parade. It was later encouraged by the departure of the local militia company with 200 or more employees, and the formation of a General Electric military company. The first American flags were bought by individuals. Then subscriptions were started. They met with ready responses. Americanized foreigners, and workmen of foreign extraction were quite as liberal

FIG. 1—EMPLOYEES' FLAGS FLYING ALONG MAIN AVENUE OF SCHENECTADY WORKS

in contributing as others of native descent. A spirit of keen rivalry started among the employees of scores of buildings and departments, and flag after flag was purchased and hoisted, each one a little larger than its predecessor.

More than $2,000, it is estimated, has been spent in purchasing flags since the movement started. Forty-three flags now float from the company's workshops, many of them of unusual size and rare coloring. There

FIG. 2—FLAG RAISING EXERCISES

are three flags which measure 24 x 40 ft., and one monster which is the largest in the works or in the city of Schenectady. Its dimensions are 40 x 60 ft.

The flag-raising ceremonies are conducted during the noon hour and usually marked by good speechmaking, singing, and often some novel and spectacular feature in connection with the unfurling. When the flag on building "No. 7" was raised scores of miniature American flags concealed in the folds of the larger one were released and fluttered down upon the crowd. American beauty roses were used in a similar manner at building "No. 8." Women employees as well as the men have taken up the flag idea, and when the flag was raised from the wiring supplies building "No. 77," a girls glee club of employees sang patriotic airs to the accompaniment of the inspiring music of the General Electric band of fifty musicians. Officials of the plant, including Vice-president Emmons, manager of the Schenectady works, take a keen interest in the flag ceremonies and are almost invariably on hand.

The company decided early that it should express its patriotism in keeping with the 24-hr. operation of its busy shops. That meant 24-hr. patriotism. The idea was to fly a large American flag from the main office building and illuminate it at night.

The flag was flown from the roof of the main office building and four reflectors fitted with Mazda lamps were placed on the roof below the flagpole. The rays from the reflector bring out every detail of the flag at night and it stands out in bold contrast to the darkness. Recently a larger flag was put up and the number of reflectors increased to fourteen. So successful has the electrified flag been that other branches of the company located in other cities have been considering the erection of electric flags.

PACIFIC GAS & ELECTRIC TO INCREASE STORAGE

Thirty-five Feet to Be Added to Height of Lake Spaulding Dam, Raising Structure to 260 Ft. Above Surface of South Yuba River.

The Pacific Gas & Electric Company is about to add 35 ft. to the height of its dam at Lake Spaulding, thereby raising the structure from 225 ft. to 260 ft. above the

surface of the South Yuba River and increasing by 50 per cent the storage capacity of the lake, which is now the main reservoir of the company's system in the high Sierras.

The Lake Spaulding dam was completed to its present height of 225 ft. in the fall of 1913, and with it the new South Yuba-Bear River development of the company put into operation. The purpose of the dam is not only to increase the company's water storage in the Sierra country, but also to divert the waters of the South Yuba into Bear Valley in order to connect up with the Bear River ditch at Colfax and, through that, to add materially to the company's deciduous fruit lands in the Sacramento valley.

In connection with the Spaulding dam was constructed the Drum power plant in the Bear River, some nine miles below the lake, and the initial power installation was over 33,000 hp. capacity. The engineering survey for the South Yuba-Bear River development included a string of power houses to utilize the fall of water all the way down between Spauling and Newcastle below Auburn. Two of these subsidiary power developments, those heretofore known as Nos. 4 and 5, respectively, are now under course of construction, one in Christian Valley, near Clipper Gap, to be called the N. W. Halsey power plant, the other in Auburn Ravine, below the city of that name, to be called the James H. Wise plant. It is expected that these will be completed before winter sets in and with their completion another 33,000 hp. will be added to the electric generating capacity of the South Yuba-Bear River development.

And now, with the purposed increase in the height of Lake Spaulding dam, the supply of water, and also electric power, will be guaranteed against interruption by the increase of water storage in Lake Spaulding from 43,600 to 63,900 acre-ft., or, in round numbers, 20,600,000,000 gal.

The contract for this work has been awarded to Twohy Brothers of San Francisco. Work is to commence as soon as the flood waters of the Sierras have subsided sufficiently to leave the crest of the dam clear. This will probably be in the early part of September. It is hoped to finish the work by winter.

The Pacific Gas & Electric Company also purposes to spend approximately $250,000 in the construction of tunnels and other equipment necessary to supply the territory surrounding Newcastle with water for irrigation and other purposes.

REPORT OF NEW YORK LIGHTING COMMISSION

During 1915 Gas-Filled Lamps Were Substituted for Almost All Arc-Lamps and Electric for Gas Lighting on Large Scale

The report of Commissioner William Williams of the Department of Water Supply, Gas and Electricity of the city of New York for 1915 has just been published. In the field of street and park lighting the outstanding features during the year were the substitution of nitrogen lamps for all but a few hundred of the 15,291 arc lamps which on Jan. 1, 1915, were in use in Greater New York and the substitution of electric for gas lighting on a large scale. In discussing these features in the report the commissioner says:

"Continued experience throughout 1915 with the new gas-filled lamp satisfies the department that it made no mistake when in 1914 it began on a small scale the use thereof in place of the arc lamp. It emits a softer, better diffused and steadier light than does the arc lamp, and is more economical, requiring no trimming and less cleaning. On multiple circuits it is more economical for the further reason that where arcs are used on such circuits about one-third of the current passing over the wires must be taken up by a compensator before it reaches the lamp and is thus wasted. Experience shows the life of the gas-filled lamp to be such that approximately three a year suffice for a lamp post. Generally speaking the arc lamps have made way for 300-watt or 400-watt gas-filled lamps on multiple circuits and for 100, 400 or 600-cp. lamps on series circuits.

"The gradual substitution of electricity for gas in street lighting has been in progress for many years. In 1906 the street lighting appropriations for the boroughs of Manhattan and the Bronx were apportioned to electricity, gas and naphtha in the respective proportions of 49, 45 and 6. In 1913 these figures were respectively 70.5, 27 and 2.5, and two years later they were 77, 21 and 2. A new impetus was given this process of substitution through the coming on the market in the spring of 1915 of the 200-watt gas-filled lamps, which the department decided to use on a new type of ornamental iron post to be owned by the city. Over 2500 of them were installed in Manhattan during 1915, and with the new lamp mentioned constitute a great improvement in street lighting. These new lamps give twice as much light at the lamp as gas, while the illumination at the darkest points between the lamps, based on the usual spacing in Manhattan, is far better than at the darkest points between the gas lamps. They are also more economical than gas. They cost the city at the rate of $43 per annum, the gas lamps at the rate of $22.37. In numerous instances gas lamps have been replaced by 200-watt gas-filled lamps in the ratio of five to two. The new iron posts cost the city about $22 each, and should have a life of at least twenty years. Not only are they far more sightly than the old gas posts, but since fewer of them will be required, there will be fewer lamp posts to be damaged by collision and otherwise and fewer obstructions on the sidewalks. The total number of gas lamps eliminated during 1915 within Greater New York with substitution therefor of electric lighting is about 20,000, of which 9000 are in Manhattan. It is our expectation that by the end of 1916 not a single gas lamp will be burning on the streets of Manhattan."

Public Service Commission News

Indiana Commission

That litigation might be avoided, the Public Service Commission has withdrawn its order forbidding the Southern Indiana Power Company to put into effect a new schedule of rates which affected a contract between the city of Bedford and the company. It was pointed out that the contract whereby Bedford was provided with energy for the operation of its water pumps was made before the commission came into existence and that the agreement had not yet expired.

The original order for a change of schedules was made last November upon a petition that the company was making special rates to certain concerns. The commission then ordered a new schedule to be filed, which order was complied with. Objections were raised by the city and others. Other petitioners were overruled in their protest and will be called upon to abide by the November schedule. The original order has been held in abeyance for six months to see how the revenues of the company would be affected.

An order that rates filed by the Noblesville Heat, Light & Power Company shall go into effect Sept. 1 has been issued by the commission. The order provides

for a minimum monthly charge of $1 for one class and $2 for another class of rural patrons using electric service. It was held that owing to the much smaller number of patrons that might be served by one transformer the company was entitled to make such a charge to rural consumers, while fixing 50 cents as the same fee for city consumers. The rates are 10 cents per kilowatt-hour for the first 25 kw.-hr. 8 cents per kilowatt-hour for the next 25, and 6 cents per kilowatt-hour for the next 50 kw.-hr.

Massachusetts Commission

Chief Justice Rugg of the Supreme Judicial Court has granted a writ of error to the Western Union Telegraph Company to enable it to carry the Foster stock-ticker case to the United States Supreme Court. The Massachusetts Public Service Commission recently ordered the company to supply service to Foster and the Supreme Court of the commonwealth affirmed the board's order. Questions of interstate and intrastate jurisdiction are involved, with contractual relations between the telegraph interests and the New York Stock Exchange. Counsel for Foster urged the court to exercise its discretion and permit the order of the commission to be carried out pending proceedings in the highest tribunal, but this was refused without statement of reasons. Foster claims that the United States Supreme Court has no jurisdiction in the matter, while the companies involved hold that the business is of interstate character.

Washington Commission

That the Washington Water Power Company, in quoting to business consumers a lower rate on contracts than on month to month payments, is "practicing discrimination," was the decision of Chairman A. A. Lewis of the Public Service Commission.

The new business rates now being quoted by the company are 7 cents per kilowatt-hour for the first 30 kw.-hr., 3 cents per kilowatt-hour for all energy used over this amount, and a discount of 25 per cent to contract holders. Non-contract holders do not get the discount.

These rates are not on file with the commission. The power company says they will be filed Sept. 1. Meanwhile it is signing up contracts at the new rates.

The decision is the result of a letter sent to Commissioner Fassett by the M. Seller Company and referred by the commissioner to the Public Service Commission for its decision.

Mr. Seller wanted to know if the power company could discriminate legally by charging non-contract holders a higher rate than that quoted to contract holders. He had been offered the new rate, he said, with the discount only on condition that he signed a three-year contract. "No tariff is on file with the Public Service Commission by the Washington Water Power Company," says the decision of the commission, "which covers a base rate of 7 cents, a secondary rate of 3 cents and a 25 per cent discount if the contract is made for a period of three years.

"We presume that the service wanted either is the commercial lighting rate or the combined power and light rate. The minimum term on the schedule is one year. If a tariff is filed by the company covering the rates as suggested in your letter, the company evidently would be practicing discrimination in deviating from such tariff provisions, either in the rate or term limit."

Illinois Commission

The order of the State Public Utilities Commission of Illinois in the sale of the Chicago Tunnel Company to the Chicago Telephone Company has just come to hand. The terms upon which the purchase and sale were approved by the commission are as follows:

1. That the total price to be paid for the property shall not exceed $5,536,192, of which sum not exceeding $3,236,192 shall be paid by the Chicago Telephone Company.

2. That the property described which is not usable by the Chicago Telephone Company as part of its plant or system shall be resold and transferred by the Chicago Telephone Company to the American Telephone & Telegraph Company for the consideration of $704,134, to be paid in cash.

3. That the Chicago Telephone Company shall not charge to its capital account by reason of said purchase any amount exceeding $1,532,058, which has been found to be the value of the property to be acquired which is usable as part of the plant and system of the Chicago Telephone Company, including the tunnel rights to be acquired, which are valued at $438,639; and that proper deductions shall be made from said sums for the value of any of the property not actually delivered to the purchaser in substantially as good condition as on March 11, 1916, ordinary wear excepted.

4. That during the life of said tunnel rights, which will terminate on Feb. 19, 1929, the said sum of $438,-639, representing the value of said tunnel rights, shall be amortized by said Chicago Telephone Company by making equal annual charges to its operating expenses so that the whole amount thereof shall be eliminated from the capital account of said Chicago Telephone Company not later than Feb. 19, 1929.

5. That any sum paid by said Chicago Telephone Company on account of said purchase in excess of the amount of $1,532,058, representing the value of the property which it can use, and the further sum of $704,-134, representing the value of the property to be resold, shall be charged to its corporate surplus account and shall not be capitalized.

6. That whatever sum is paid by said American Telephone & Telegraph Company on account of said purchase shall be contributed only out of its surplus funds otherwise available for dividend purposes, and shall be charged to its corporate surplus account and shall not be capitalized nor charged to or collected from the Chicago Telephone Company.

7. That the Chicago Tunnel Company shall pay the city of Chicago the sum of $500,000, being the compensation required for the privilege and consent conferred by its ordinance of March 11, 1916.

8. That the Chicago Tunnel Company and the Chicago Telephone Company shall accept the said ordinance of March 11, 1916, as required therein.

9. That upon the acquisition of the said telephone plant and system by the Chicago Telephone Company, said company will grant to the intervening independent telephone companies over the lines and through the exchanges of the Chicago Telephone Company, all the facilities for connection with Chicago patrons which said independent companies now have, either directly or indirectly, over the lines and through the exchanges of said Chicago Tunnel Company, and will fully preserve and maintain the rights and facilities for long distance connections which said intervening independent companies now enjoy, directly or indirectly, through connections with the said Chicago Tunnel Company.

The question of physical connection between the Chicago Telephone Company and the independent telephone companies, and the terms upon which such physical connection may be made and the cost thereof divided, unless the companies reach an agreement thereon, are matters which the commission reserves for future determination in any proceeding which may be brought for that purpose under the statute.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Study of Hydroelectric Sites in Chile.—An honorary commission has been appointed by the Ministry of Industry and Public Works to make a study of the water power available in Chile for the purpose of hydroelectric development.

More Power for Staten Island.—The Richmond Light & Railroad Company has just completed the installation of a 7500-kw. turbo-generator for supplying light and power to Staten Island, N. Y. The company is also installing four new boilers.

Everett Considering Municipal Plant.—Robert Howes, consulting engineer of Seattle, who has been engaged by the city council of Everett, Wash., to investigate the power possibilities of the Sultan River where a proposed municipal lighting plant may be constructed, reports that 72,500 electrical horsepower can be delivered at Everett for a twelve-hour period or 36,250 hp. for a continuous period. The estimated cost of developing the full 72 500 hp. is placed by Mr. Howes at $6,127,000. According to the city engineer the city will not need all of this power for many years and plans to install one unit at a time.

Examination for Cable Tester.—Applications will be received by the Municipal Civil Service Commission, Municipal Building, Manhattan, New York City, until Aug. 22, for the position of cable tester. The successful contestant must be able to locate brakes and tests for electrolysis of cables and also must be able to make a separate test on wires and cables, underground conduits, manhole accessories, firehouse and public building wiring for alarm system and pole line equipment. Candidates must have had an actual laboratory or field experience in cable testing of at least one year. The compensation proposed for this position is from $1,140 to $1,380 per annum.

Extension of Electric Service of Aid to Osteopaths.—The availability of electricity in even the smaller towns has been a distinct aid to osteopaths, according to many members of the American Osteopathic Association, which held its twentieth convention in Kansas City recently. Several manufacturers of and dealers in electric diagnostic and therapeutic instruments had exhibits, and some reported extensive sales. High frequency machines and vacuum instruments have long been popular; osteopaths are becoming more interested in the X-ray, and their entrance into eye, ear, nose and throat work more extensively has made necessary the use of devices for lighting these parts for examination.

Lexington Franchise Purchased.—The Lexington Utilities Company has bought at the upset price of $10,000 the twenty-year franchise prepared for the city of Lexington, Ky., by the Utilities Bureau of Philadelphia. The franchise, effective on Nov. 1, involves a reduction of about 40 per cent in schedule to 9 cents per kilowatt-hour for residential lighting, 8.5 cents per kilowatt-hour for commercial, 8 cents per kilowatt-hour for power, with a general 10 per cent discount and special discounts to large users. Revision of the rates every four years is also provided for.

City Wants 6 Per Cent on Its Investment for Energy to Be Furnished Cleveland Railway Company.—In a communication to Street Railway Commissioner Sanders last week, Commissioner of Light and Heat W. E. Davis stated that the municipal plant will furnish the additional energy needed by the Cleveland Railway at a rate that will return 6 per cent on the investment necessary for that purpose. If the company decides to purchase energy from the city instead of improving its Cedar Avenue station a bond issue of $1,750,000 will be submitted to the voters at the November election. It is estimated that this additional expenditure will be necessary to purchase the equipment required to furnish the energy needed by the road.

Detroit to Have Electric Show.—During America's Electrical Week, Dec. 4 to 9, the Exhibitors' Association, Inc., in conjunction with the various electrical associations of Detroit, will stage an elaborate electrical show in the Armory. W. S. Reynolds, secretary of the Exhibitors' Association, reports that more than 50 per cent of the entire space has already been reserved by well-known local and outside electrical firms. A rate schedule for the space has been announced, and also a policy whereby the exhibitors will share in the net profits from the show. A liberal advertising policy has been established, and elaborate decorations are to be supplemented by novel features to attract people, and the admission price will be 50 cents in the evening and 25 cents in the afternoon.

Kansas City Light & Power Company Expands.—The Kansas City Light & Power Company has moved its meter and stores departments to a building recently purchased at Twenty-first and Walnut Streets. This building has been intended for a steam heating plant, but is to be used temporarily for these other purposes. The company is establishing at this place also an electric charging station for its automobiles. For the present the company will continue to occupy part of the building at Fifteenth Street and Grand Avenue, owned by the Kansas City Railways Company, though both the light company and the railways company probably will have other offices later. The former electric charging station of the light company at Thirteenth and Charlotte Streets probably will be leased to a private concern which will actively develop service to electric vehicle owners.

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next-to-last text page.

Dallas Electric Club.—Friday, Aug. 11 was known as Electric Appliance Day with the Dallas (Tex.) Electric Club and Jovian League. A meeting was held at the Southland Hotel.

Cleveland Electrical League.—September 1 is the date that has been set by the Cleveland Electrical League for moving into its new quarters, built on the roof of the Hotel Statler. F. C. Foster of the Buckeye Lamp Division of the General Electric Company has been appointed chairman of the formal opening committee, and the date of that event will be announced within a short time.

Electric Vehicle Section, N. E. L. A., Meeting.—A meeting of the executive committee of the Electric Vehicle Section of the National Electric Light Association was called Aug. 4 in New York, with A. S. Mansfield in the chair. Plans were discussed for putting into effect the detail plans of closer co-operation with the central stations which affiliation with the National Electric Light Association makes more natural. Representatives of the manufacturers present stated that business was exceptionally good and that in some cases deliveries could not be promised for several months ahead. Committee organization was perfected for carrying out the work of the section for the coming year.

Pennsylvania Electric Association.—The ninth annual convention of the Pennsylvania Electric Association will be held Sept. 6-8 at the Forest Inn, Eagles Mere Park, Pa. Besides reports by committees on rates, engineering, accounting, safety and welfare, geographic sections and municipal street lighting, the following papers will be presented: "Construction Records and Accounts," by H. C. Hobson, Wilkes-Barre; "Construction Costs," by F. Heinbokel, Warren; "Storeroom and Tool Records," by W. P. McArdle, Pittsburgh; "Method of Securing Consumers Deterred by First Cost of Wiring," by E. C. Newman, Connellsville; "Increased Use of Electric Ranges and Small Appliances in the Home," by H. W. Reed, Altoona; "Testing of Current and Potential Transformers," by W. A. Fogler, Philadelphia; "Boiler-Room Operations," by H. H. Wilson, Harrisburg; "Classification of Men, Wages and Methods in Ctntral Station Industry," by J. F. Martin and H. N. Müller, Pittsburgh, and "Cost and Factors in Underground Construction," by W. H. Keating and H. N. Müller, Pittsburgh. H. M. Stine, 211 Locust Street, Harrisburg, is the executive secretary of the association.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

ELECTRICAL VEHICLE OUTLOOK VERY BRIGHT

Past Six Months' Sales Record Breaking, With Every Indication of Banner Year for Industry in 1917

With the months of July and August, which are always the dead months in the electric pleasure vehicle industry, showing sales way beyond the expectations of the dealers and manufacturers, and with many live prospects for the fall buying season, the electric vehicle industry is moving to greater production in a most optimistic frame of mind. In many instances the pleasure cars are sold out to the point that none are available for demonstration purposes.

One prominent company has sold its entire year's production sixty days in advance of expectation, and had at the end of the second week in August only three unsold cars in the entire country. The past six months was the best in the history of this company. Another company's July sales were 25 per cent greater than the previous high mark. A third company had experienced unprecedented sales each month since the first of the year and was having difficulty in producing cars fast enough to keep up with the demand, although its output has been doubled. Its salesrooms are empty of show cars. The 40 per cent increase in July sales over July a year ago, together with the previous unusual demand, has kept them completely sold out. Sales from coast to coast of a fourth manufacturer have increased 141 per cent for 1916 over 1915, and his July sales in Chicago alone were 200 per cent greater than in July last year. This same manufacturer is planning a 200 per cent production increase for 1917, and expects a great revival in the industry.

There is also a very pronounced demand for used cars, one dealer having sold over 200 this year, and many other dealers state that there is a ready market for all the second-hand electrics they can obtain and at good prices.

The electric truck business, too, is enjoying unusual activity, due principally to two factors. First, the high price of gasoline has made many commercial users of trucks look with more interest upon the electric, with its constantly low and decreasing cost of fuel supply, especially as the indications are that there will be little further reduction in the price of gasoline for some time. Second, the war departments of Europe are consuming the outputs of the truck makers, and have also requisitioned all good horses and gasoline trucks to the end that all that can be secured in these countries to replace these and which will not be requisitioned, are electric trucks. One company reports a 500 per cent increase in foreign business over last year, and the receipt of cabled orders almost every week. These are being received from Norway, England, South Africa, Cuba and other countries.

The domestic demand for trucks is such that orders are booked several months in advance of production. One company is adding further machines and increasing its factory space, and also plans to begin working a night shift very soon for what is believed to be the first time in the history of the industry. Numerous orders for whole fleets of electric trucks have been received during the past few months, and other big orders are pending and practically assured, notably one for fifty three-ton and five-ton trucks. A similar order for two-ton and one-ton trucks had to be turned down by one manufacturer recently because it was impossible to make delivery as required in two months. A steadily increasing demand is noted by all the manufacturers, and no change ahead can be seen except for the better. High cost and delayed delivery of materials are causing some trouble, but with the plans for the fall peak business well under way, there will probably be little delay in the delivery of vehicles from this cause. The sales campaigns being planned, and the advertising appropriations which are larger than ever, together with the other influences working to the good of the electric vehicle, undoubtedly will result in a total of fall sales overshadowing any previous year.

In Chicago the action of the local electric vehicle section of the National Electric Light Association in adopting a working agreement between manufacturers, dealers and garage men, as chronicled in the July 1 issue of ELECTRICAL WORLD has already brought about beneficial results. Work done in this connection has resulted in a noticeably more friendly feeling among the various electric vehicle interests and a tendency to further co-operation and united effort to boost the electric car. This better relationship naturally will react to the good of the electric vehicle sales in Chicago and vicinity.

ELECTRICAL MANUFACTURER DISCUSSES COPPER CONDITIONS

Substitutes for Copper Resorted to Owing to Shortage of Metal — He Foresees a Strong and General Tendency to Construct Greatly Improved Plants After the War

Dr. Schuyler Skaats Wheeler, a past-president of the American Institute of Electrical Engineers and president of the Crocker-Wheeler Company, Ampere, N. J., manufacturer of electrical equipment, believes that replacements in the mills of this country as the result of war pressures on machinery will have an important effect on the copper market long after the war is over. In a published statement he said:

"I do not think the present high price of copper will continue, but it will be a long time before it returns to its former level of 15 cents a pound. Granted that production in America is greater than ever, most of it is under contract before it is shipped from the smelters, and there are practically no accumulations of metal to be found in 'middle hands.'

"The situation in copper will be quite like that in the machinery trade. When the war is over a great quantity of copper will be required to restore depleted equipment, to bring stocks back to normal levels and to put back much which has been stripped from various places and diverted to war purposes. We ourselves, after having bought copper from the same interests for thirty years, were formally notified some time ago that under existing conditions of unusual stress we should for the present purchase only our allotment, based on past orders. We wanted more, not less, and like the engineers of warring countries, we have been forced to devise methods of making some articles from other materials. As copper goes down, more and more of these things will be 'thrown back'; that is, many articles will again be made of copper that are more difficult to make otherwise, and finally there will be a return to the use of copper in those things which can quite easily be made otherwise, and which are almost but not quite as good.

"Leading manufacturers the country over have been so rushed with orders that they have had no time to keep their equipment up to a normal state of efficiency. When the war is over they will start to put their houses in order—to bring their power plants up to requirements—to replace worn-out machinery with larger and more modern equipment, and there will undoubtedly be a strong and general tendency to construct greatly improved plants out of new and large surpluses."

OBSERVATIONS ON THE RAW MATERIAL SITUATION

What the Average Electrical Manufacturer Has Suffered, What He Is Now Undergoing and What He May Have to Contend With Later

When the European war broke out and raw material prices, recovering from the first shock, began to climb like a chasing monoplane, many electrical manufacturers held favorable raw material contracts. These documents specially quoted prices and deliveries very much more advantageous to the buyer than were available in the open market. But the raw material men, realizing that the question of delivery to the electrical people was vital, have, it is said, in many cases called on the electrical people to tell them flatly that deliveries under those favorable contracts would cease to be made. In some cases deliveries or orders already partly filled were peremptorily stopped and it was necessary for the electrical concerns to give new orders at increased prices so that deliveries would be resumed. Of course the electrical men are still holding their copies of the uncompleted contracts and may at some time be in a position to collect what is justly due them. The process of collection looks hardly to be one of a pleasant character, however.

Now these raw material sellers have their electrical customers signed up on long-term contracts at prices favorable to themselves. Some electrical factories that use expensive metals have at present purchased enough raw material for two years' normal output, the prices being the market quotation at the date of entry of the order. Stories are beginning to circulate to the effect that raw material men are deliberately curtailing their output in order to prevent deliveries from returning to their former out-of-stock state. This, of course, the raw material men emphatically deny, but still the electrical manufacturers continue to hear the reports and continue to believe them—partly, perhaps, because they want to.

In addition to believing these reports the electrical manufacturers are acting on the strength of them, and are purchasing for far future needs. By these far future purchases the electrical men are silently declaring that price increases which recently have been necessary will remain effective for some time to come. It is even probable that reductions in prices of manufactured goods will have a considerable lag behind raw material prices in the future.

It is difficult for the electrical manufacturer to see a silver lining in his raw material cloud at present. Perhaps there is none; but if they can collect on the uncompleted contracts which they hold, can continue to convince themselves and others that the only-for-the-present business policy of the raw material sellers is wrong, and is one which they themselves will never adopt, and can find lessons of economy in the far future buying with which they are now having experience, the silver lining may later become visible.

PROGRESS IN MANUFACTURE OF ELECTRIC MATERIAL IN SPAIN

Domestic Companies Develop Output During 1915—But Production Is Not Yet Able to Dominate Spanish Markets

Marked progress has been shown in the manufacture in Spain of electric material, according to Consul General Carl Bailey Hurst. Domestic companies developed their output during 1915, and at present a profitable business is being done by a company at Sabadell and another at Cornella, near Barcelona, where transformers, generators and motors up to 200 hp., and electrotechnic apparatus of a superior grade are manufactured. In Barcelona firms employing large numbers of operatives specialize in electric cables and electric lamps. Carbons are extensively manufactured there and much electric material of the smaller kinds. Domestic production is not yet able to dominate the market, however, and Spain is still dependent on foreign countries for quantities of electrical material, as indicated by the import statistics. According to the industrial tax statistics there are 992 plants producing electric light for the public use, 978 for private use, and 125 electric plants furnishing motor power.

VAST MARKET CREATED BY AUTOMOBILE INDUSTRY

Opportunities for Makers of Dynamo Parts, Switches, Lamps, Storage Batteries, Etc.—Dealers and Contractors Not Alive to Opportunities

With the increasing popularity of gasoline automobiles there has developed a demand for electrical auxiliaries that is astounding. Only a slight indication of its magnitude is given by the United States census report, showing that $6 000,000 worth of small dynamos were sold in 1914, because the number of automobiles equipped with lighting sets has increased surprisingly since then.

Engineers closely in touch with the automobile industry declare that practically all automobiles will be equipped with electric lighting sets this year and nearly all of these except the very cheap cars will also have motor starters. When it is considered that possibly 1,000,000 automobiles will be made this year in addition to the million contemplated by the Ford Motor Company, it can be imagined how great will be the demand for armatures, commutators, segments, brushes, controllers, ball bearings, low-voltage wiring switches, storage batteries, charging regulators, lamps, electric horns, etc.

While very few of the long-established electrical manufacturers have awakened to this vast market for electrical equipment, the equipment is being secured in some way. In many cases the apparatus is being made by specialists in automobile electrical auxiliaries who with the technical and commercial backing of experts have made enviable incomes. In a few cases the long established electrical manufacturers have furnished the equipment. One manufacturer of small motors located in Ohio furnished approximately 450,000 dynamos to one company alone last year. Other motor-starter and automobile-generator manufacturers are buying the parts from different concerns and are assembling them. Some starters and lighting sets are being made by electrical manufacturers as a side line.

Opportunities for the sale of switches, lamps and batteries are as great if not greater than for motors and generators, because several of the first two items are used on each car. The lamp business is especially attractive because the lamps on each car must be replaced in many cases at least twice a year and because the unit profit is much greater than for lamps used for domestic lighting. Storage batteries also have to be renewed or overhauled sometimes twice a year in this service, because the automobile users generally do not know how to give them the proper care.

Surprising as it may be, however, electrical dealers as a whole are not reaping the benefit of this business and very few electricians and small contractors, if any, are letting automobile users in their territory know that they are authorities on remedying automobile electric troubles. Automobile supply stores are selling the supplies and garages are making the repairs. This condition exists probably because automobile users do not look outside automobile supply stores for supplies and because electricians and contractors usually have no place to house cars awaiting repairs. Electrical dealers and contractors should be able to get the business, however, one electrical manufacturer believes, if they will do more publicity work and co-operate with local automobile agencies, by notifying the latter that they are in a position to furnish all electrical auxiliaries and accessories and are equipped to do repair work.

Dealers and contractors, however, should acquaint themselves with all automobile electric accessories on the market and should understand how they are constructed and how they operate. Manufacturers of electric supplies could secure names for a valuable mailing list by asking automobile agencies in moderate sized towns to select some progressive electrical dealers in their locality to handle automobile electric supplies.

Manufacturing and Industrial

The Hygrade Lamp Company, Salem, Mass., has recently been awarded a contract for incandescent lamps for use by the state of Iowa. For the past two years the state of Massachusetts has also placed its contract for incandescent lamps with the Hygrade company.

Electric Controller & Manufacturing Company.—A building permit has been issued to the Electric Controller & Manufacturing Company, Cleveland, Ohio, for the erection of a five-story steel and concrete structure as an addition to its plant at 2698 East Seventy-ninth Street. The first three floors are to be used for manufacturing purposes and the two upper floors for offices.

Lamp Voltage Standardization.—It is hardly possible that the lamp voltage standardization movement discussed in an article on page 200 of the ELECTRICAL WORLD for July 22 will become general immediately. In the meantime it is understood the National Lamp Works, which is very active in promoting this move for standard voltage, will continue as before to supply customers with lamps of other voltages as required.

The Equi-Light Company, Paducah, Ky., has recently been formed and is manufacturing a device called the "Equi" which is designed to regulate electric lamps on Ford cars. The company is also about to place on the market an electric starter. E. C. Phelps is president of the company, H. E. Wallace, vice-president and Mrs. Bertha Phelps, secretary and treasurer. Mr. Wallace, vice-president of the company, has had considerable experience in the electrical field.

Outside and Window Electric Signs.—The Silver Creek (N. Y.) Sign Company is manufacturing a line of outside electric signs varying in size from 18 in. by 48 in. to 24 in. by 72 in. It is also making window signs of the one-side type in sizes of 10 in. by 18 in., 11 in. by 22 in. and 12 in. by 24 in. The latter-named signs are being used in quantities by the Duffy Malt Whiskey Company, the Miller Tire Company, the World's Medical Dispensary and the Hein Candy Company. According to the manufacturer, the materials used in the construction of the signs are selected to make a strong, durable sign throughout. Use is made of copper, 22-gage galvanized steel coated with aluminum, double-strength glass, and especially prepared pigments.

Japan Seeking Electrical Trade in China.—According to announcements in Japanese papers Japan is about to make a strong bid for electrical trade in China. Japan's electrical industry has recently undergone a marked development, it is stated, and the government is therefore considering means to encourage the export of electrical apparatus not only to China, but to India and other accessible places. It is considered that the present time is especially auspicious for developing a foreign market for Japanese electrical goods due to the fact that European competition has largely been eliminated on account of the war. In order to push the exports of Japan's electrical appliances to the above-named countries it is proposed to subsidize the movement with a government appropriation.

Westinghouse Company Gives Toledo Central Station Helping Hand.—Recently the Toledo Railways & Light Company purchased a condenser that lacked a pumping equipment. Subsequently a pumping outfit was ordered from the Westinghouse Electric & Manufacturing Company, but due to the large number of unfilled orders on hand the latter-named company could not ship the equipment immediately to Toledo as desired. This pumping outfit was needed very badly because the central station company could not increase its output for the coming winter season without the additional equipment. The Westinghouse people fortunately, however, came to the rescue of the central station company and offered to loan it a pumping equipment wheih had been in operation in a plant of the Brooklyn Rapid Transit Company. This equipment will be shipped to Toledo without cost to the Toledo company and will enable it to place the condenser in operation by Sept. 1.

The Moore Steam Turbine Corporation, Wellsville, N. Y., has recently been formed and proposes to build single and multi-stage turbines with ratings of from 5 hp. to 1000 hp. The company will also place on the market turbo-generator sets, turbo pumps and turbo blowers, and will manufacture a full line of double helical herringbone reduction gears which will be sold in connection with the turbines. It is not the intention of the company to develop or build any electrical apparatus. All generators used in connection with its turbines will be purchased from manufacturers of electrical equipment. J. L. Moore, president of the company, was formerly chief engineer of the Kerr Turbine Company. E. D. Spicer, secretary and treasurer, was formerly chief draftsman of the Kerr Turbine Company, and J. B. Laird, vice-president, was formerly factory manager and purchasing agent of the Kerr Turbine Company. Besides the above-named officers, the following are directors of the company: E. C. Brown, J. H. McEwen and L. H. Thornton.

Recent Gas Engine Installations.—Some of the recent orders received by the Bruce-Macbeth Gas Engine Company, 2122 Center Street, N. W., Cleveland, are as follows: The Faultless Rubber Company, Ashland, Ohio, one 350-hp. engine (the fourth gas engine ordered by this concern); F. E. Myers & Brothers, Ashland, Ohio, two engines (second and third repeat orders within a year); The Antler Hotel, Youngstown, Ohio, one 30-hp. engine; the Eastman Machine Company, Buffalo, N. Y., one 40-hp. engine; A. E. Gruber, Pittsburgh dressed beef market and abattoir, one 40-hp. unit for lighting elevators and refrigeration; the Borough of Emporium, Pa., one 150-hp. unit for municipal service (repeat order being a duplicate of a gas engine installed in the city two years ago); the Tygart Glass Company, Grafton, W. Va., one 150-hp. unit; the Bellview Garage, Milwaukee, Wis., one 150-hp. producer gas engine directly connected to generator for lighting and charging storage batteries; the Ted House, Youngstown, Ohio, two duplicate units for lighting, power and elevator service, and the American Window Glass Company, Pittsburgh, Pa., one 250-hp. unit.

Manufacture of Electrical Supplies in the Netherlands.—Consular Agent A. C. Nelson, Scheveningen, Holland, states in a recent report that among the more important industries connected with the machinery trade in the Netherlands is that devoted to the manufacture of electric motors, dynamos, convertors, batteries, carbureters, measuring instruments, telephones, X-Ray apparatus, electric timepieces and incandescent lamps. There are over fifty important electric-supply works in the country. Dynamos and electric motors are made at Slikkeveer, near Rotterdam, while other manufacturers of electrical apparatus are found at Hengelo, Utrecht, Alkmaar, Gilze Ryen (near Breda), de Bilt, Rotterdam, and Dordrecht. Five establishments are engaged in the manufacture of metallic and carbon filament lamps; the one at Eindhoven employs about 3000 operators. The others are at Venlo, Tilburg, Nymegen, and Boxtel. These lamps find a ready market all over the world, especially in England, Denmark, Germany, Russia, Sweden, Norway, France, Belgium, Spain, Switzerland and Italy. A factory at Middelburg that makes brass fittings for incandescent lamps (employing about 400 hands) produced 54,000,000 fittings in 1910. At Vaals, in the Province of Limburg, is found an arc-lamp plant, and at Amsterdam a factory that produces cables and wires of all sorts for telephones and bells, as well as for submarine purposes.

Lamps for Flood-Lighting Niagara Falls.—As a result of a recent demonstration of the "Davis" flood-lighting equipment, the Western Electric Company, 195 Broadway, New York, has been awarded the contract for flood-lighting equipment for the illumination of Niagara Falls. The unit which will be used is of a standard type that the Western Electric Company has installed in various parts of the country for flood-lighting bathing beaches, large industrial plants, railroad yards, etc. The lamp consists of a large cast-iron base, a hollow iron pipe standard and the case proper. Each unit is equipped with a 1000-watt Type C "Mazda" lamp and a polished-glass reflector which has only one adjustment and which throws the ray from the lamp in either a diffusing flood or a narrow beam. The demonstration referred to above was performed with the assistance of the Niagara Falls Hydraulic Company. One battery of five lamps was placed below Prospect Point and shot their rays across the American falls at an upward angle. Across on Goat Island at the crest of Luna Falls, was placed another battery of fifteen lamps which sent their rays downward and

across the Luna and American cataracts. A third battery, consisting of five lamps, was on the west parapet of Goat Island bridge. The latter-named lamps played upon the rapids down to the brink of the falls. The effect of the illumination, it is reported, was unique and awe inspiring.

Cooper Hewitt Lamps in Canadian Shipbuilding Plant.—The establishment of a shipbuilding plant in Canada by Vickers, Ltd., of England, is of great significance and has aroused a great deal of enthusiasm and interest. In the past Canada has been too busy developing her great natural resources to even think of building her own ships. Now that her trade has become a factor in the commerce of the world, however, she has awakened to the immense advantages that will undoubtedly accrue from the establishment of such an industry. The Canadian plant is known as Canadian Vickers, Ltd., and is located at Longe Pointe, one of the eastern suburbs of Montreal One of the features of the equipment that has proved of remarkable help in obtaining efficiency and speed in production is the system of artificial lighting employed. In the shipbuilding berth, iron workers' shed, engine and boiler shop, and other of the larger buildings where it is necessary to do accurate work Cooper Hewitt mercury vapor lamps are used. These lights are of 3500 cp. each, and are arranged in such a way that there is no glare or deep shadows. With this system the light is so evenly diffused, it is asserted, that the finest print, or scale and micrometer readings can be deciphered with ease. Vickers, Ltd., in England have the reputation of being one of the foremost engineering institutions, and in their English plants they have been using Cooper Hewitt mercury-vapor lamps for a number of years. They are said to have a total installation in their different plants, of about 2000 such lamps.

NEW YORK METAL MARKET PRICES

	Aug. 8 Selling Prices Bid	Aug. 8 Selling Prices Asked	Aug. 15 Selling Prices Bid	Aug. 15 Selling Prices Asked
Copper	£ s d		£ s d	
London, standard spot	107 0 0		114 0 0	
Prime Lake	25.50	to 26.00†	26.25	to 26.75†
Electrolytic	26.50	to 27.00†	27.00	to 27.25†
Casting	24.00	to 24.25†	24.37½	to 24.62½†
Copper wire base	31.00†		31.00†	
Lead	6.00		6.00	
Nickel	45.00	to 50.00	45.00	to 50.00
Sheet zinc, f.o.b. smelter	15.00†		15.00†	
Spelter	8.42½	to 8.67½	9.17½	to 9.42½
Tin, straits	37.75		39.00	
Aluminum, 98 to 99 per cent	56.00	to 58.00†	56.00	to 58.00†
OLD METALS				
Heavy copper and wire	19.50	to 20.50†	21.00	to 21.50†
Brass, heavy	12.00	to 12.25†	12.50	to 12.75†
Brass, light	9.00	to 9.50†	9.00	to 9.50†
Lead, heavy	5.00	to 5.12½†	5.00	to 5.12½†
Zinc, scrap	6.00	to 6.25†	6.00	to 6.25†

COPPER EXPORTS

Total tons to Aug. 15 13,456

†Nominal.

Corporate and Financial

American Light & Traction Company, New York, N. Y.—The board of directors has declared the regular quarterly cash dividend of 1.5 per cent, to holders of preferred stock; a quarterly cash dividend of 2.5 per cent to holders of common stock, and a stock dividend to holders of common stock, at the rate of two and one-half shares of common stock on every 100 shares of common stock outstanding; all payable Aug. 1, to stockholders of record at the close of business July 15. The earnings of the company for the twelve months ended June 30, 1915 and 1916 were as follows:

	1916	1915
Earnings on stocks of subsidiary companies	$5,075,908	$3,980,302
Miscellaneous earnings	576,406	754,962
Gross earnings	$5,652,314	$4,735,264
Expenses	187,345	157,600
Net earnings	$5,464,969	$4,577,664
Surplus and reserve previous year	10,194,492	9,577,664
	$15,659,461	$14,155,328
Less dividends:		
Cash dividends on preferred stock	$854,172	$854,173
Cash dividends on common stock	1,715,250	1,553,332
Stock dividends on common stock	1,715,250	1,553,332
Total dividends	$4,284,672	$3,960,837
Surplus balance	$11,374,789	$10,194,491

Associated Gas & Electric Company, New York, N. Y.—An issue of $725,000 of collateral trust 6 per cent sinking fund gold bonds due Jan. 1, 1941, is being offered at 98.5 and interest, netting about 6.15 per cent.

Great Western Power Company, San Francisco, Cal.—The California Railroad Commission has issued an order authorizing the Great Western Power Company to issue $224,000 face value first mortgage 5 per cent sinking fund 40-year gold bonds at not less than 90 per cent of face value, plus accrued interest, and to reacquire these bonds at the same price for delivery to the company's trustee under its first mortgage payment of sinking fund obligations, due July 1, 1916. The company proposes to reimburse its treasury on account of expenditures for extensions, additions and betterments amounting to $249,350, against which no stock, bond or other securities have been issued, by issuing the bonds authorized to the Western Power Company of New Jersey, and to repurchase them at the same price and use them to pay the trust deed obligation. Under this mortgage the Great Western Power Company is obligated to pay the Central Trust Company of New York on July 1, 1916, and annually, to create a sinking fund, 1 per cent face value of the bonds outstanding, and in lieu of cash may surrender to the trustee for cancellation first mortgage bonds. The company's outstanding bonds amount to $22,397,000.

Municipal Service Company, Philadelphia, Pa.—A block of 5 per cent collateral trust sinking fund gold bonds due March 1, 1932, is being offered at 95.5 and interest.

Securities in Fifth British List.—The fifth list of American securities which the British Government is prepared to purchase has been made public by the American dollar securities committee. Included in the list is a large number of public service corporation securities. Those in the light and power field are as follows: American Cities Company, collateral trust bonds, 5 and 6 per cent, due 1919; American Light & Traction Company, 6 per cent cumulative preferred stock; California Gas & Electric Corporation, general mortgage and collateral trust 5 per cent bonds, due 1933; Central Illinois Public Service Company, first and refunding 5 per cent bonds, due 1952; City Electric Company, first mortgage 5 per cent bonds, due 1937; Consolidated Gas, Electric Light & Power Company of Baltimore, common stock; Gas & Electric Company of Bergen County, consolidated mortgage 5 per cent bonds, due 1949; Georgia Electric Light Company, first mortgage 5 per cent bonds, due 1930; Great Falls Power Company, first mortgage 5 per cent bonds, due 1940; Illinois Northern Utilities Company, first and refunding 5 per cent bonds, due 1957; Kings County Electric Light & Power Company, convertible 6 per cent debentures, due 1922; Louisville Gas & Electric Company, first and refunding mortgage 6 per cent bonds, due 1918; Montana Power Company, 7 per cent cumulative preferred stock; Northern Electric Company, first mortgage 5 per cent bonds, due 1939; Pacific Gas & Electric Company, first and second 6 per cent preferred stock; Paterson & Passaic Gas & Electric Company, first consolidated mortgage 5 per cent bonds, due 1949; Pennsylvania Water & Power Company, first mortgage 5 per cent bonds, due 1940; Philadelphia Company, consolidated mortgage and collateral trust 5 per cent bonds, due 1951; Puget Sound Power Company, first mortgage guaranteed 5 per cent bonds, due 1933; Springfield Railway & Light Company, first lien 5 per cent sinking fund bonds, due 1926; Syracuse Lighting Company, first mortgage 5 per cent bonds, due 1951; Utah Light & Power Company, Consolidated mortgage 4 per cent bonds, due 1930; Utah Securities Corporation, ten-year 6 per cent gold notes, due 1922; Utica Electric Light & Power Company first mortgage 5 per cent bonds, due 1950; Utica Gas & Electric Company, refunding and extension mortgage 5 per cent bonds, due 1957; Westchester Lighting Company, first mortgage 5 per cent bonds, due 1950.

Standard Gas & Electric Company, Chicago, Ill.—A sixty-four page booklet has been printed and distributed describing the public utility properties in which the company owns investments. The company has a controlling ownership in fourteen of the sixteen utility companies in which it is financially interested. These sixteen subsidiary companies

render electric, gas and other varieties of service to 275 communities with a total estimated population in excess of 1,800,000. Of the total gross revenue 69 per cent is derived from the sale of electricity for power, lighting and heating. At the close of 1915 the 325,153 customers served were classified as follows: Electric, 188,623; gas, 130,617; telephone, 2979; water, 1927; steam heat, 1007. The operating units at the close of 1915 had installed in their power houses 243,054 electrical horsepower, of which 65,530 hp. was water power, and the remainder, with the exception of a small fraction, steam driven. During 1916, 39,400 additional horsepower is being installed.

Toledo (Ohio) Traction, Light & Power Company.—Cities Service Company has offered to buy the outstanding stocks of Toledo Traction, Light & Power Company, issuing its own securities in payment therefor on the following basis: For each share of Toledo Traction, Light & Power preferred stock, Cities Service Company will give in exchange one share of its 6 per cent preferred stock. For each share of Toledo Traction, Light & Power common stock Cities Service Company will give in exchange 0.35 of a share of its 6 per cent preferred stock and 0.07 of a share of its common stock. The privilege of making these exchanges extends until Sept. 1, 1916, and conversion will be made as of that date. The first dividend to be received on Cities Service preferred and common stocks issued through these exchanges will be the dividend payable Oct. 1. The offer of Cities Service Company to make these exchanges is contingent upon the assent of the holders of a substantial majority of both classes of stock, and the company reserves the right to withdraw this offer unless the holders of 75 per cent of each class of stock assent to this exchange.

New Utility and Industrial Companies

The Jaegar Manufacturing Company of Wilmington, Del., has been chartered with a capital stock of $500,000 to manufacture electrical devices of all kinds for the killing of insects. The incorporators are: L. A. Irwin, M. L. Rogers, Harry W. Davis, all of Wilmington, Del.

The Pine Grove Electric Light, Heat & Power Company of Warren, Pa., has been incorporated with a capital stock of $5,000 to operate in Pine Grove Township, Warren County. The incorporators are: H. A. Siggins, D. H. Siggins, E. A. Dupree, John Siegfried and S. Q. Smith of Warren.

The American Power Company of Bridgeport, Conn., has been incorporated by John J. Hogan of Bridgeport; John G. Hoffman of New York, N. Y., and John T. L. Hubbard of Hartford, Conn. The company is capitalized at $100,000 and proposes to manufacture an engine which is the invention of James J. Hogan.

The Gold Seal Battery & Electric Company of New York, N. Y., has been incorporated with a capital stock of $10,000 for the purpose of installing batteries, motors, electric apparatus, generators, machinery, etc. The incorporators are: A. Scheiber, L. Silverman and R. Martin, 1036 Simpson Street, the Bronx, New York, N. Y.

Trade Publications

Fiber Devices.—The Delaware Hard Fiber Company, Wilmington, Del., has prepared a circular listing prices of various fiber products.

Rectifier.—The Imperial Electrical Company, Union City, Ind., has published an illustrated folder which describes a rectifier for charging storage batteries.

Battery Switches.—The Trumbull Electric Manufacturing Company, Plainville, Conn., has issued a folder containing information on several types of battery switches.

Electric Dishwasher.—The National Machine & Stamping Company, Detroit, Mich., is sending out an illustrated bulletin containing information on its motor-driven dish-washing machine.

Small Transformers. — The Empire Transformer Company, 2723 North Clark Street, Chicago, Ill., is sending out an illustrated folder which describes several types of small transformers.

Heating Apparatus.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued leaflet No. 3918 which describes various types of industrial heating apparatus.

Portable Lamps.—The Rubes Electric Devices, Inc., Brooklyn, N. Y., has published an illustrated folder which contains information on its portable electric reel lamp recently described in these columns.

Annunciators.—The Deveau Telephone Manufacturing Company, 472 Eighteenth Street, Brooklyn, N. Y., has published an illustrated bulletin which contains considerable information on various types of annunciators.

Reed-Ware Lighting Fixtures.—The Chicago Reed Ware Manufacturing Company, 315 Union Park Court, Chicago, Ill., is sending out a folder which lists and illustrates various types of its reed-ware lighting fixtures.

Electric Bells and Lighting Fixtures.—The Kandem Electric Company, 29 East Twenty-first Street, New York, has prepared circulars which contain information on its electric bells and K-10 semi-indirect lighting fixtures.

Small Lighting Outfit.—The Swartz Electric Company, Indianapolis, Ind., has prepared an illustrated folder which is printed in colors and describes the company's self-contained gasoline engine driven generating outfit.

Electric Hand-Drying Apparatus.—The Notowl Manufacturing Company, 302 West Water Street, Syracuse, N. Y., has published an illustrated booklet containing information on its electrically-heated hand-drying equipment.

Incandescent-Lamp Reflectors.—The National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, has issued a bulletin entitled, "The Magnets of Trade," which describes and illustrates various types of reflectors.

Lighting Fixtures.—The Harter Manufacturing Company, 1132 West Austin Avenue, Chicago, Ill., has prepared catalog No. 6 which is illustrated and lists various types of ornamental lighting fixtures and different kinds of accessories.

Watt-hour Meters. — The Sangamo Electric Company, Springfield, Ohio, has prepared Bulletin No. 44, which is attractively illustrated and contains considerable information on its Type D5 direct-current two-wire and three-wire mercury-type watt-hour meter.

Flow Meter and Cooling System.—The Spray Engineering Company, 93 Federal Street, Boston, Mass., has issued Bulletin No. 201, entitled, "Spraco System for Cooling Condensing Water," and which is attractively illustrated. The company has also published a booklet describing the Vaughan flowmeter and a folder entitled, "Cooling Water for Ice Plants."

Lighting Company's Selling Campaign. — The Westinghouse Lamp Company, 165 Broadway, New York, has prepared a booklet entitled "Cash for Your Idea" describing a new campaign which the company intends to conduct for the benefit of electrical salesmen. The matter contained in this booklet is purely educational and in no way, the company states, is the publication to be confined only to the Westinghouse organization. The booklet is to be issued monthly and no contributions will be used for advertising purposes.

Markets for Machinery and Machine Tools in Peru, Bolivia and Chile.—The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has just issued a bulletin designated as Special Agent Series No. 118 and entitled "Markets for Machinery and Machine Tools in Peru, Bolivia and Chile." The bulletin was prepared by Special Agent J. A. Massel, who has made a careful analysis of the industries that use machinery and machine tools in the above-named countries, and has pointed out all the worth while opportunities for American manufacturers. The prospects for future development are explained carefully, and there are useful lists of the principal dealers and users. The report contains eighty-eight pages and may be obtained for a nominal sum.

New England

EAST CORINTH, ME.—The Bangor Railway & Electric Company is planning to erect a substation at East Corinth in connection with the extension of its electric-lighting and power service to the towns along the Kenduskeag Valley reached by the electric railway.

NASHUA, N. H.—The city of Nashua has entered into a new contract with the Nashua Light, Heat & Power Company for street-lighting for a period of seven years. The contract provides for replacing the lamps now in use with nitrogen-filled incandescent lamps.

RUTLAND, VT.—Work has been started on the Silver Lake hydroelectric development promoted by the Mortonia Power Company of Rutland. Excavation for the power house on the east shore of Lake Dunmore, in Addison County, is now under way. The dam will be 300 ft. long and will develop about 9600 hp. The equipment will include three 3200-hp. turbines.

BOSTON, MASS.—Bids will be received by the Schoolhouse Commissioners of the city of Boston, 1007 City Hall Annex, until Aug. 29, for construction, complete, of an elementary school for upper grades, at Gibson and Bispham treets, Dorchester, Boston. A deposit of $25 will be required for a complete set of plans and specifications; also a deposit of $15 for heating and ventilating or electrical plans with specifications.

LENOX, MASS.—Improvements will be made to the plant and system of the Lenox Electric Company, which was recently taken over by C. D. Parker & Company of Boston, Mass., involving an expenditure of between $20,000 and $30,000. New transformers, cables and other equipment will be purchased.

NEWBURYPORT, MASS. — The City Council has authorized Mayor Fogg to sign a contract with the Newburyport Gas & Electric Company for lighting the city for a period of ten years. Under the terms of the contract the company is to install a complete new lighting system, at an initial expenditure of $12,000. Lamps of 800, 430 and 100 cp. will be used.

PEABODY, MASS.—Bids will be received at the office of the Peabody Electric Light Department, Town Hall, Peabody, until Aug. 21 for furnishing and installing a turbo-generator (alternating current), condensers, pipings and changes in building in accordance with plans and specifications on file in the above office. Warren D. King is manager.

EAST NORWALK, CONN.—At an election to be held Sept. 1, the proposal to discard the municipal electric-lighting system and enter into a contract with the United Electric Light & Water Company of South Norwalk for street-lighting, will be submitted to the voters. The company has made a proposal to the town offering to lease the municipal plant for a period of 20 years at $1,600 per year and furnish street-lighting and commercial service.

WINDSOR LOCKS, CONN.—Foundations have been completed for the new electric power plant to be erected at the mill of C. H. Dexter & Sons on the canal bank.

Middle Atlantic

BINGHAMTON, N. Y.—The Binghamton Light, Heat & Power Company has purchased a site of 20 acres on the Susquehanna River near Johnson City, on which it will erect a new central power plant. The initial generating capacity of the new plant will be 7500 hp., but provision will be made to install additional generating units as needed. It is planned to have the new plant in operation by Jan. 1, 1917. W. S. Barstow & Company, 50 Pine Street, New York, N. Y., will have charge of the work.

BROOKLYN, N. Y.—William Williams, commissioner of water, gas and electricity, at the next meeting of the Board of Estimate will renew his request for $300,000 with which to establish a municipal electric-lighting system in the Thirtieth Ward in the borough of Brooklyn, which covers 8 square miles. The contract for street-lighting expires next month. Three plans have been presented by David F. Atkins, chief engineer of lighting and power. One provides for a renewal with the gas lighting company and the Welsbach Street Lighting Company upon a more favorable basis than at present. The second proposes to replace gas with electricity, the units to be supplied by the Edison Electric Illuminating Company and the third provides for the city to purchase and install an entire electric street-lighting equipment, including underground and overhead conductors, poles, lamp-posts, lamp fixtures, transformers and to supply energy from one central point from Edison Company. Commissioner Williams would also make provision to light the public schools, fire houses and police stations.

EAST VIEW, N. Y.—Bids will be received by the Building Commission of Westchester County, 15 Court Street, White Plains, N. Y., until Aug. 23, for construction of a water-works system for the new County Buildings at East View. The work will consist of sinking wells, making connections, furnishing and installing pumps and motors, furnishing and erecting pumping stations, furnishing and laying pipes, hydrants and appurtenances and furnishing and erecting water tank and tower. Plans are on file in the office of the commission, White Plains, and at the office of Ward, Carpenter Company, 95 Franklin Street, Tarrytown, N. Y.

GENEVA, N. Y.—The Council has adopted an ordinance authorizing the city clerk to advertise for bids for lighting the village. The present contract expires on Nov. 19, 1916. The contract will be for a period of ten years and will provide for furnishing energy for the new lighting system, which according to the specifications will consist of about 300 100-watt lamps, replacing the 47 arc lamps and 11 small lamps now in use.

STAPLETON, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 1 for the installation of an electric passenger elevator and two electric dumbwaiters in the United States Marine Hospital, Stapleton, Staten Island, N. Y.

SYRACUSE, N. Y.—Bids will be received by the Trustees of the New York State College of Forestry in the chancellor's office, Syracuse, N. Y., until Aug. 22 for construction, heating and power plant, plumbing and drainage and electric work for power house at the New York State College of Forestry, Syracuse University. Drawings and specifications may be consulted at the College of Forestry, Syracuse University; at the New York office of the Department of Architecture, 1224 Woolworth Building, New York, N. Y., and at the Department of Architecture, State Capitol, Albany, N. Y.

CHESTER, PA.—The construction of a new power plant is among the extensive improvements contemplated by the Chester Paper Company.

HARWOOD, PA.—The Harwood Electric Company contemplates building a one-story addition to its power plant. The Schofield Engineering Company, Commercial Building, Philadelphia, Pa., has charge of the engineering work.

PUNXSUTAWNEY, PA.—The Jefferson Electric Company of Punxsutawney is reported to be contemplating the construction of a concrete dam across the Mahoning Creek.

BUTLER, N. J.—The Council has passed on second reading an ordinance providing for an appropriation of $10,000 for the municipal electric-lighting system. Of this amount $5,000 is to be used for improvements to plant and extension of lines; the balance is to take care of a deficit in appropriation last year.

NEW BRUNSWICK, N. J.—The City Commissioners are negotiating with the Public Service Electric Company for the installation of an underground conduit system in important streets. The commissioners are also considering the advisability of establishing a municipal electric-light plant.

TRENTON, N. J.—The Board of Commissioners are considering the construction of a new electric building for city department. W. P. Endebrock is architect.

WEST VIVIAN, W. VA.—The equipping for electrical operation of about 15 miles of the Norfolk & Western Railway, from West Vivian to Farm, a distance of 10 miles, and from Tug, near Welch, to Wilcoe, 5 miles, is under consideration.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Brooklyn, N. Y., Schedule 9974—12 engine room clocks, 20,000-2-hole wire terminals, 12 portable hand tachometers; Schedule 9969—50 water heaters, 35 20-in. by 24-in. rectangular mirrors; Schedule 9971—710. lb. galvanized iron wire, 18 tenton hydraulic jacks; Schedule 9973—miscellaneous brass pipe and tubing copper; Schedule 9—12,000 ft. 2-conductor telephone cable; Schedule 5—700 standing lamps; Schedule 8—10,000 lb. sheet brass; Schedule 9991—two condensate meters. Mare Island, Cal., Schedule 9980—312 ¾-in. by 15-in. gage glasses. Washington, D. C., Schedule 9985—100 magnifying lenses, 400 objective lenses, 200 sets of sextant mirrors, f.o.b. works; Schedule 9981—46 air compressors. Mare Island, Cal., Schedule 9988—four centrifugal horizontal pumps. Philadelphia, Pa., Schedule 9—15,900 lb. pipe and tubing copper, Schedule 1—1000 lb. tubing copper; Schedule 8—6400 lb. brass bar, 3600 lb. sheet copper. Boston, Mass., Schedule 5—134,000 lb. brass voice tubing. Applications for proposal blanks should designate the schedule desired by number.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

North Central

BAY CITY, MICH.—The Municipal Electric Light Department will install immediately an ornamental lighting system, to cost about $10,000. William H. Fitzhugh is superintendent.

BIG RAPIDS, MICH.—The electrical contract for the addition to the Ferris Institute at Big Rapids has been awarded to the Roseberry-Henry Electric Company of Grand Rapids.

HANCOCK, MICH.—The City Council has engaged N. B. Beattie to prepare plans and estimates for a municipal electric-light plant, to cost from $62,500 to $175,000. A bond issue will be submitted to the voters at the November election.

BALTIC, OHIO—The Sugar Creek Light & Power Company has been granted a franchise to install and operate an electric-light plant in Baltic.

FOSTORIA, OHIO—The Ohio Light & Power Company is contemplating extending its service to the northwestern section of Seneca County to supply electricity to farmers in that section. The company will use the Fostoria-Fremont transmission line.

LIMA, OHIO.—Plans are being prepared for the construction of a factory, including power house, for the manufacture of rubber goods by the Hester Tire & Rubber Company. A site of three acres has been secured and it is understood that work will begin in the fall.

MEDINA, OHIO—The Village Council has granted the Ohio Gas & Electric Company a franchise to construct and operate an electric-light and power plant in Medina for a period of 25 years.

PERRYSVILLE, OHIO.—The Board of Trustees, it is reported, is asking for bids for the reconstruction of the local electric-light plant.

VENEDOCIA, OHIO—The North Western Ohio Light Company of Van Wirt has submitted a proposal to village of Venedocia offering to supply electricity in this village.

YOUNGSTOWN, OHIO.—The Bell Telephone Company is planning improvements to its local system, which will include six additional switchboard sections and the installation of considerable amount of underground work, in the business district. Extensions will also be made to the aerial equipment.

MOUNT STERLING, KY.—Improvement of the old lighting plant at Mount Sterling, so that it may be held in readiness to supply electrical service in emergencies, is reported to be under consideration by the Kentucky Utilities Company.

NEON (Not a Post Office), KY.—A company is being organized to establish an electric light and power company in the new town of Neon in the Boone's Fork coal fields in Letcher County. The installation of an ice plant is also under consideration.

PERRYVILLE, KY.—Arrangements, it is reported, are being made by Russell Brothers, owners of the local electric-light plant and ice factory, to rebuild their electric plant, which was recently destroyed by fire.

BLOOMFIELD, IND. — The Indiana Power & Water Company, a holding company for the Utilities Development Corporation of Chicago, Ill., which recently purchased the property of the Home Light & Power Company of Bloomfield, has been incorporated with a capital stock of $200,000. The company proposes to supply electricity in the towns of Worthington, Bicknell, Bloomfield, Odon, Newberry and Lyons. The headquarters of the company will be located in Bloomfield. Archibald C. Keene will be resident manager.

DANVILLE, IND.—The property of the Danville Light, Heat & Power Company has been purchased by the American Public Utilities Company of Grand Rapids, Mich. Extensive improvements to the distribution system is contemplated by the new management; also considerable increase in the light and power service and some extensions of transmission lines.

ELWOOD, IND.—The Indiana General Service Company of Elwood is increasing the efficiency of its high-tension transmission lines by installing another skirt on all dead ends. The company is making radical changes in its out-door high-tension switching tower at the Alexandria substation, with a view of simplifying the operations. O. E. Halderman is superintendent.

FRANKFORT, IND.—Extensive improvements to the municipal electric light and power plant, including the installation of one 1500-kw. turbine complete, one spray cooling water system, one 50-kw. motor generator exciter set and coal handling equipment, are under consideration. R. W. Hendrix is secretary.

HOBART, IND.—The electric light commissioners are contemplating replacing one Brownell 150-hp. boiler. The erection of 3 miles of three-phase, 60-cycle, 1100-volt transmission lines to rural districts is now under way. Murray H. Owens is superintendent.

MARION, IND.—The Public Service Commission has approved a contract under which the Marion Light & Heating Company will supply electricity for incandescent street lamps in Fairmount on a basis ranging from $18 to $37.50 each per year.

ALBANY, ILL.—Arrangements are being made by the Albany Electric Light & Power Company for the construction of an electric-lighting system in Albany. Energy will be secured from the transmission lines of the Clinton (Iowa) Gas & Electric Company connecting at the city limits in South Clinton, thence south and over Beaver Island. The wires will be strung across the Mississippi River between two 100 ft. steel towers; the span across the river will be 1800 ft.

BEARDSTOWN, ILL.—Bids will be received by the Commissioners of the South Beardstown Drainage and Levee District of Cass County at the office of Robert W. Hunt & Company, engineers, 2200 Insurance Exchange Building, Chicago, Ill., until Sept. 5, as follows: (1) Excavation, placing sheet and round piling, and building plain and reinforced concrete foundations for a pumping plant; (2) erection of building, screens, furnishing and installing pumps, motors, piping and other equipment. All material to be ready for erection April 1, 1917. For further information address the engineers or C. C. Garm, secretary, Beardstown, Ill.

CHICAGO, ILL.—Plans have been prepared for the installation of a 4000-kw. rotary converter at the Franklin Street substation of the Commonwealth Edison Company.

CHILLICOTHE, ILL.—The Santa Fe Railroad has awarded a contract to the Lundgren & Carlson Construction Company of Topeka, Kan., for the construction of a power house in Chillicothe, to cost about $10,000.

DECATUR, ILL.—The Municipal Electric Light Department is contemplating extensions to the ornamental street-lighting system and will erect a new transmission line from the water-works to the city, a distance of 1½ miles. Material required will include 5 miles of No. 6 weatherproof wire, one feeder panel for switchboard, and three 2200-volt, alternating-current arresters. William Logan Rice is city electrician.

ELGIN, ILL.—Bids will be received by the Board of Administration, Capitol Building, Springfield, Ill., until Aug. 22, for power plant piping and accessories for new power house at the Elgin State Hospital, Elgin. Plans and specifications may be obtained upon application to Martin C. Schwab, consulting engineer, Mallers Building, Chicago, Ill.

EVANSTON, ILL.—Bids will be received at the office of the Commissioner of Public Works, City Hall, Evanston, Ill., until Sept. 8 for the designing, construction and erection complete of a steam driven pumping unit of sufficient capacity to pump continuously 10,000,000 (U. S.) gallons of water per 24 hours against a head of 120 ft. with steam pressure of 165 lb. Plans and specifications may be obtained upon deposit of $10. Irving C. Brower is commissioner of public works.

GALESBURG, ILL.—Improvements are contemplated to the municipal electric-light plant, including the installation of two constant-current transformers for 200 nitrogen-filled Mazda lamps of 400 c.p. The city is now considering the installation of ornamental lamp standards and changing circuits so as to use Mazda and magnetite street lamps. John Walsh is superintendent.

GENESEO, ILL.—The proposal to issue bonds for the installation of electric-light and gas plants will be submitted to the voters on Aug. 23.

GIBSON CITY, ILL.—The City Council has engaged Melluish & Broyhill, Unity Building, Bloomington, Ill., consulting engineers, to prepare plans and take charge of construction of the proposed municipal electric-light plant and water-works system.

JOLIET, ILL.—The Canal Commission has accepted the bid of the Sanitary District of Chicago for the lease of the hydroelectric power project at dam No. 1 at Joliet, under the terms of which the Sanitary district is to pay at the rate of $105,000 per year for twenty years. Under the terms of the contract the district will construct a new hydroelectric power plant at Joliet, to cost about $500,000, and the city of Chicago will get 10,000 new lamps at a cost as low as is now paid for the park and street lamps furnished by the drainage board.

LEBANON, ILL.—The contract for improvements to the municipal electric-light plant has been awarded to F. C. Schwaner & Company, Bank of Commerce Building, St. Louis, Mo. The Fuller-Coult Company, Chemical Building, St. Louis, Mo., has charge of the engineering work.

MARSHALL, ILL.—The city of Marshall is contemplating rewinding generator in the municipal electric plant with No. 6 square wire. S. O. Tibbs is city collector.

BERLIN, WIS.—Bids will be received by the Board of Education, City Hall, Berlin, until Sept. 6, for construction of a high school building. Separate bids to be submitted as follows: (1) General contract; (2) plumbing, heating, automatic temperature control and clock and program system. Plans and specifications may be obtained on application to Parkinson & Dockendorff, La Crosse, Wis.

MILWAUKEE, WIS.—The Wisconsin Railroad Commission has granted the Wisconsin Telephone Company permission to issue $988,000 in capital stock, the proceeds to be used for new construction, which will include extension and improvements to its lines.

CHASKA, MINN.—Bids will be received by J. M. Aretz, city clerk, Chaska, until Sept. 1, for construction of water-works system, including water distribution system, concrete reservoir, 100,000 gal. capacity, 8-in. well, 200 ft. deep and electrically-operated pumping machinery. Plans and specifications may be seen at the office of the city clerk, Chaska, or at the office of J. A. Rowatt, consulting engineer, Willmar, Minn.

ERSKINE, MINN.—Bonds to the amount of $5,000 have been voted for the installation of a municipal electric-light plant.

MIDDLE RIVER, MINN.—The contract for the installation of an electric-light plant in Middle River has been awarded to H. J. Olsen. The street-lighting system will consist of 15 lamps, and 50 buildings will be wired.

SAUK CENTER, MINN.—The installation of an ornamental lighting system (four to ten blocks) is under consideration. E. D. Jackson, Capital Bank Building, St. Paul, is engineer.

BRIGHTON, IOWA.—The property of the Brighton Hydro-Electric Company has been purchased by George Carson of Iowa City, president of the Iowa Gas & Electric Company, which operates plants at Washington, Mount Pleasant and Wayland. The company will probably be reorganized and merged with the Iowa Gas & Electric Company, which will build a permanent dam on the river and erect a transmission line from Washington to connect with the Brighton line.

CEDAR RAPIDS, IOWA.—The Iowa Railway & Light Company of Cedar Rapids is planning to erect a high-tension transmission line into Atkins soon to supply electrical service there.

DANBURY, IOWA.—Bids will be received by J. C. Jacobson, city clerk, Danbury, until Aug. 29 for the purchase of the municipal electric-light plant. A 25-year franchise will be granted the purchaser. Further information may be obtained of the city clerk.

IRWIN, IOWA.—Bids will be received by the board of directors of Irwin, until Sept. 9, for construction of a two-story and basement high and grade school, including heating, ventilating, plumbing and wiring. Plans and specifications may be obtained at the office of W. F. Gernandt, architect, Keeline Building, Omaha, Neb.

JESUP, IOWA.—Bids will be received by R. L. Bordner, secretary of Jesup consolidated school district, until Sept. 12, for construction of a new grade and high school building, separate bids to be submitted as follows: (1) General building; (2) heating and plumbing; (3) electrical work. Plans and specifications may be seen after Aug. 22 at the office of the secretary at Jesup, and at the office of Harry E. Netcott, architect, Independence, Iowa.

LONE TREE, IOWA.—The property of the Lone Tree Light & Power Company has been purchased by the Iowa Electric Company of Cedar Rapids. The Iowa company is contemplating the erection of a high-tension transmission line from Iowa City to Hills, to Iowa Junction and thence to various points in the vicinity of towns through which the line will pass.

SPENCER, IOWA.—Plans and specifications are being prepared by W. E. Skinner, consulting engineer, Plymouth Building, Minneapolis, Minn., for improvements to the municipal electric-light plant. Generating equipment of about 300 kw. capacity will be installed.

DOUGLAS, N. D.—The Village Council has granted a franchise to William Johnson to construct and operate an electric-light plant in Douglas.

LA MOURE, N. D.—Plans are being prepared by W. E. Skinner, consulting engineer, Plymouth Building, Minneapolis, Minn., for the installation of an electrically-operated pumping plant for the city of La Moure.

UNDERWOOD, N. D.—The Village Board has granted J. O. Hendricks a franchise to construct and operate an electric-light plant in Underwood for a period of 20 years.

ALCESTER, S. D.—The contract for the erection of an electric transmission (10 miles) and distribution system in Alcester has been awarded to the A. Hubbard Electric Company, 103 East Fifth Steeet, St. Paul, Minn.

BURCHARD, NEB.—An election will soon be held to submit to the voters the proposal to issue $4,000 in bonds for the installation of an electric-lighting system.

HOLMES, NEB.—Investigations, it is reported, are being made by H. M. Byllesby & Company of Chicago, Ill., for construction of a hydroelectric power plant at Holmes by G. W. Steinmeyer of Beatrice.

OMAHA, NEB.—Work has begun on the construction of the addition to the power plant of the Omaha Electric Light & Power Company at the foot of Jones Street. The cost of the building is estimated at $120,000. The work includes the building of a tunnel about 150 ft. long, 8 ft. wide and 18 ft. deep. A 20,000-hp. turbine, engines and other equipment will be installed. The cost of the entire work is estimated at about $900,000.

SCOTIA, NEB.—Bids will be received by the city of Scotia until Aug. 30, for construction of an electric-light plant and water-works system, to cost about $15,000. H. L. Miller is clerk. The Martz Engineering Company, Orpheum Building, Lincoln, Neb., has charge of the engineering work.

SHUBERT, NEB.—Arrangements are being made for the installation of a municipal street-lighting system for which bonds to the amount of $6,500 have been voted. Electricity will be obtained from the municipal plant at Stella.

WAHOO, NEB.—Bids will be received by the city of Wahoo until Aug. 30 for the purchase of one 225-hp. Corliss engine to be directly connected to a 150-kw. 60-cycle, 2300-volt generator, two switchboards, one 35-hp. 2200-volt, slip-ring motor and one triplex pump. For details see proposal columns. H. M. Robertson is superintendent.

BELPRE, KAN.—At an election held recently the proposal to issue $10,000 in bonds for the erection of an electric transmission line and distribution system was carried. I. C. Bushong of Ottawa, is engineer.

CLAFLIN, KAN.—The Claflin Telephone, Light & Garage Company has recently built an addition 25 ft. by 40 ft., to its power house and also installed a 50-hp. oil engine. E. R. Ruck is owner and manager.

CLAY CENTER, KAN.—An addition is being built to the municipal electric-light plant to provide space for a new 312-kva. generator and engine, and stokers. All equipment has been purchased with the exception of switchboard and conduits. C. F. Rasmussen is superintendent.

HURON, KAN.—The city of Huron is contemplating the erection of a transmission line to secure energy from the Atchison (Kan.) Railway & Light Company.

LEWIS, KAN.—Bonds have recently been voted to provide funds for the erection of a transmission line from Kinsley to Lewis and a distribution system here. I. C. Bushong of Ottawa is engineer.

NETAWAKA, KAN.—At an election held recently the proposal to issue bonds for the installation of a municipal electric-lighting system was carried. Energy will probably be secured from Holton.

OLPE, KAN.—The installation of a municipal electric-light plant in Olpe is under consideration.

PARSONS, KAN.—Bids will be received by J. W. Howe, secretary Board of Control, State House, Topeka, until Aug. 28, for construction of Insane Asylum at Parsons. Separate bids to be submitted on heating, plumbing and electric wiring. C. H. Chandler, State House, Topeka, is architect.

TOPEKA, KAN.—Announcement of the purchase of the Leavenworth & Topeka Railroad by the Wallard E. Winner interests of Kansas City from the Santa Fe and Union Pacific companies has been made. The road will be converted into an electric line to give interurban service between Kansas City and Topeka, a distance of 56 miles. Several extensions, it is said, will be built.

Southern States

CARY, N. C.—The city of Cary is considering issuing $10,000 in bonds for the construction of an electric-light system. It is proposed to erect a transmission line from Method to Cary. Electricity will be secured from the Southern Power Company.

CHADBOURN, N. C.—Preparations are being made for the construction of an electric-light plant in Chadbourn. Generators and prime movers have been purchased. J. A. Brown is interested. B. O. Austin of Charlotte, N. C., is consulting engineer.

DUNN, N. C.—The installation of an ornamental street-lighting system is under consideration. Gilbert C. White of Charlotte, N. C., is engineer.

LENOIR, N. C.—The construction of a hydroelectric plant on John's River is under consideration by James Moore and others.

LUMBERTON, N. C.—Improvements are contemplated to the municipal electric-light and water plant, involving an expenditure of about $5,000.

RALEIGH, N. C.—The Carolina Power & Light Company of Raleigh, it is reported, is contemplating the construction of a dam and hydroelectric plant at Little Mill site on Beaver River.

DUE WEST, S. C.—The Due West Water, Light & Power Company, recently organized, is planning to install an electric power plant to develop about 35 hp., at a cost of about $8,000. R. H. Brice is manager.

QUITMAN, S. C.—The trustees of the Agricultural High School has awarded the contract for construction of an electric-light plant and water-works system to W. H. Patton & Son, of Shubuta, Miss.

CAVE SPRING, GA.—The installation of an electric-lighting system in Cave Spring is under consideration. It is proposed to ask the Georgia Railway & Power Company to extend its transmission line from Cedartown here.

COCHRAN, GA.—At an election to be held Aug. 20 the proposal to issue $3,000 in bonds for extension to the electric-light system and water works will be submitted to the voters. The bond election recently held was declared illegal.

MACON, GA.—The Central Georgia Power Company of Macon is now increasing the output of its water power plant by 6000 hp.

MANCHESTER, GA.—A 150-hp. tubular boiler is being installed in the municipal electric-light plant. An additional generating unit, engine type, three-phase, 2300 volt, 150-kva., will be needed within the next year. Will probably establish a 24-hr. service during 1917. L. E. Hudson is superintendent.

MILLEDGEVILLE, GA. — The Oconee River Mills, electrical department, is contemplating the installation of a 300-kw. three-phase, 60-cycle, 2300-volt generator and steam engine, directly connected, at the steam plant.

BOWLING GREEN, FLA. — Arrangements are being made for the installation of an electric-lighting system, for which contracts have been awarded.

DAYTONA, FLA.—The City Council is contemplating the construction of an electric-light plant.

JACKSONVILLE, FLA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 8, for an electric elevator in the United States post office and court house at Jacksonville, Fla. For details see proposal columns.

RUSKIN, FLA.—The trustees of Ruskin College are contemplating the installation of an electric-lighting system.

HARTSVILLE, TENN.—A franchise has been granted to E. W. Rugg of Cincinnati, Ohio, to install an electric-light plant here. A five or ten-ton ice factory will be erected in connection with the electric plant.

GURDON, ARK.—The Gurdon Electric Company, recently organized, is planning to establish an electric-light plant and ice factory in Gurdon. G. P. Whittington is interested in the company.

JONESBORO, ARK.—New equipment, including a 150-hp. return tubular boiler (150 lb. pressure) and 1000-hp. heater, is needed at the municipal water and light plant. Nothing definite has been decided upon. J. F. Christy is manager.

LITTLE ROCK, ARK.—Plans are being considered to enlarge the municipal electric-light plant to supply electricity for commercial purposes.

LAFAYETTE, LA.—The City Council is considering issuing certificates to the amount of $18,000 to install new engines in the municipal electric-light plant.

ST. MARTINVILLE, LA.—Bids will be received by the city of St. Martinville until Aug. 22 for equipment for electric-light plant as follows: One 100 to 120-hp. engine, either crude oil or steam; one 75 to 80-kva., alternating-current generator; one 250-gal. per minute, and one 500-gal. per minute electrically driven pump, and one transformer for 200 series street lamps. Separate prices to be submitted for each of them. Albert Bienvenu is mayor.

CHICKASHA, OKLA.—The Chickasha Electric Light Company contemplates improvements to its system, to cost approximately $10,000.

EDMOND, OKLA.—Bonds to the amount of $9,000 have been voted for improvements to the municipal electric-light plant.

WAYNOKA, OKLA.—An election will be held Aug. 31 to submit to the voters the proposal to issue bonds for improvements to the municipal electric-light plant, including the installation of an engine in power house and extensions to water and lighting systems.

AUSTIN, TEX.—Bids will be received until Aug. 23 for the erection of power house, dormitory, laundry building and mechanical equipment for the State Colony of Feeble-Minded at Austin. Keuhne, Chasey & Giesecke of Austin are architects. For further information address Mrs. William Bacon, president of board, Austin, Tex.

DALLAS, TEX.—City Secretary Winslett will soon advertise for lamp contract for the city which recently expired.

DALLAS, TEX.—The City Commission is contemplating extending the municipal lighting system to the Sunset Hill suburb.

DALLAS, TEX.—We are informed that the Texas Power & Light Company of Dallas does not contemplate any work in Austin at this time. An item published in the issue of July 22 stated that the company contemplated the erection of a generating station in Austin.

O'DONNELL, TEX.—S. T. Singleton is contemplating installing a complete electric-light and power plant at his ranch headquarters near O'Donnell.

SAN ANTONIO, TEX.—The contract for wiring and all electrical work at the new South Side School House has been awarded to Martin Wright of San Antonio, at $19,675.

SAN SABA, TEX.—Arrangements are being made for increasing the output of the local electric-light plant with a view of furnishing a 24-hour service throughout the entire year instead of through the summer months only. The cost of the proposed improvements is estimated at $10,000.

TAHOKA, TEX.—The City Council has granted E. L. Howard a franchise to install and operate an electric-light plant in Tahoka.

WEST, TEX.—The Texas Power & Light Company of Dallas is making improvements to its local plant at a cost of about $20,000.

Pacific States

SPOKANE, WASH.—The City Commissioners have awarded the contract for the ornamental lighting system on Main Avenue, from Division to Monroe Streets, to the Washington Water Power Company of Spokane, at $49,920, which includes maintenance for 10 years.

JOSEPH, ORE.—The property of the Joseph Light & Power Company has been purchased by the Enterprise (Ore.) Electric Company, at $57,500. A transmission line will be erected at once from Joseph to Enterprise. The headquarters of the Enterprise company are at 521 First Avenue, Spokane, Wash. L. M. Simpson is general manager.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company has awarded contracts for raising the height of its dam at Lake Spaulding from 225 to 260 ft., thus increasing the storage capacity of Lake Spaulding by almost 50 per cent. Two more generating stations are now in course of construction and will add another 33,000 hp. to its generating capacity. The company has also appropriated $250,000 for the construction of tunnels and other equipment necessary to supply the Newcastle territory with water for irrigation.

BLACKFOOT, IDAHO.—The Southern Idaho Water Power Company is building a new 600-kva. out-door substation to replace the 300-kva. in-door substation. Transformers and other high-tension apparatus will be moved to Aberdeen, Idaho. A transmission line (33 kva.) is now being erected from the company's power plant at American Falls to Aberdeen and also a new distribution system in Aberdeen. James B. Brokaw is local superintendent.

RUPERT, IDAHO.—The Rupert Electric Company may be in the market for the purchase of some 2200-volt, 60-cycle transformers in sizes ranging from 100 to 150 kva. F. N. Victor is manager.

LOGAN, UTAH.—A special election will be held Sept. 2 to submit to the voters the proposal to issue $85,000 in bonds for improvements to the municipal electric-light plant and water-works system; $15,000 will be used for the electric plant and the remainder for water-works.

NOGALES, ARIZ.—The International Gas Company of Nogales is planning to erect a transmission line to connect every mining camp in Santa Cruz County within the next 60 days. Surveys for the proposed line are now being made. It will tap the Nogales-Duquesne line at Duquesne.

OATMAN, ARIZ.—The Oatman Water & Sewer Company is contemplating the construction of an electric plant, water-works and sewer system in Oatman, at a cost of more than $500,000. The company proposes to pipe water from the Colorado River to Oatman, a distance of 11 miles, and to pump it into a large storage reservoir which it will build here to supply the town and adjacent mines with water. V. S. Rowley is at the head of the company.

WILLIAMS, ARIZ.—The Grand Canyon reservoir and hydroelectric project, it is reported, has been taken over by E. P. Ripley, president of the Atchison, Topeka, & Santa Fe Railroad and his associates. The proposed project involves the construction of a dam across one of the laterals of the Grand Canyon and the storage of water for operating a large hydroelectric plant, the irrigation of more than 200,000 acres of land. Electric transmission lines, it is understood, will be erected to mining districts, towns and industrial centers within a radius of 200 miles of the generating plant. Permanent surveys will be finished and construction work, it is understood, will be started before the middle of November.

GREAT FALLS, MONT.—Active work has begun on enlarging the power station of the Montana Power Company at Rainbow Dam, which will increase the output of the plant by 10,000 kw. Orders have been placed for water wheels and other machinery required. The cost of the work is estimated at about $500,000. F. M. Kerr is general superintendent.

RAWLINS, WYO.—The Rawlins Electric Light & Fuel Company is contemplating the installation of either a 250-hp. turbine or a 250-hp. uniflow engine and a 250-hp. water tube boiler. J. H. Jacobucci is manager.

Canada

RICHIBUCTO, N. S.—The Village Councils of Richibucto and Rexton contemplate building a dam on the Kouchibouguac River and erect an electric-light plant.

CALABOGIE, ONT.—M. J. O'Brien, it is reported, is contemplating a power development at Calabogie, where it is estimated that 5000 hp. can be obtained. The plans provide for construction of power plant and the erection of a transmission line to Renfrew.

COURTWRIGHT, ONT.—The Village Council is considering asking the Hydro-Electric Power Commission of Ontario to submit an estimate of the cost of equipment necessary to serve Courtwright with electricity for lamps and motors.

DUNDAS, ONT.—The substation of the Hydro-Electric Power Commission of Ontario at Dundas was destroyed by fire on July 31, causing a loss of about $125,000.

HAMILTON, ONT.—Plans are being prepared by James Bain, chief engineer at the Beach pumping station, for the installation of additional pumping equipment at water-works, to cost about $70,000.

RENFREW, ONT.—The Town Council has decided to proceed with the development of power at the first chute of the Bonnechere River, where 1500 hp. is available.

TORONTO, ONT.—Plans and estimates are being prepared by the Ontario Hydro-Electric Power Commission for distribution systems for the municipalities of Arthur, Dunnville, Tara and Grand Valley, and for remodelling the system in Almonte.

WATFORD, ONT.—A by-law authorizing an issue of $10,000 in debentures to provide funds for the installation of hydro-electric power in Watford has been approved by the ratepayers.

Miscellaneous

NEUVA GERONA, CUBA.—An electric-light franchise for a period of 20 years, with an option for 10 years additional, has been granted to construct and operate an electric plant in Nueva Gerona, and to extend transmission lines all over the Isle-of-Pines. Orders have been placed for machinery. Crude oil will be used for fuel.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Sept. 1 for furnishing refrigerator apparatus, refrigerator doors, sash-operating device, valves, grommets, brass pulleys, inner tubes, insulating paper, etc. Blanks and general information relating to this circular (No. 1072) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

1,189,314. RELAY; Charles R. Underhill, New Haven, Conn. Orig. app. filed Aug. 4, 1914; div. app. Nov. 30, 1913; issued July 4, 1916. Mechanical arrangement of relay which gives comparatively long contact, and therefore permits uninterrupted recording of dashes by coherer.

1,189,738. DEVICE FOR THE RECTIFICATION OF ALTERNATING ELECTRIC CURRENTS; Owen W. Richardson, Princeton, N. J. App. filed June 5, 1913; issued July 4, 1916. Details of hot-and-cold electrode rectifier having high current carrying capacity.

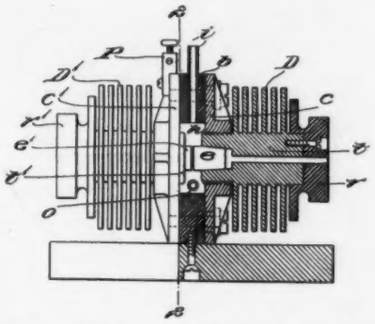


Fig. 1—Chaffee construction for spark gap. No. 1,189,791.

1,189,791. APPARATUS FOR AND METHOD OF EXCITING ELECTRIC OSCILLATIONS; Emory Leon Chaffee, Somerville, Mass. App. filed Nov. 4, 1911; issued July 4, 1916. Transmitting apparatus comprising highly cooled spark gap whose discharges maintain oscillations in a coupled circuit.

1,189,881. WIRELESS TELEGRAPHY; Frederick G. Simpson, Seattle, Wash. Orig. app. filed Nov. 1, 1912; div. app. April 23, 1913; issued July 4, 1916. Tunable microphone relay for the telephone circuit of a crystal detector.

1,190,156. SUBMARINE TELEGRAPHY OR TELEPHONY; Walter Hahnemann, Kiel, Germany. App. filed Feb. 17, 1913; issued July 4, 1916. Conductive submarine signaling in which the harmful short-circuiting effect of a metallic ship is avoided by coupling the receiving telephone to the collecting plates through a transformer having low resistance primary.

1,190,412. ELECTRODE FOR DEVICES FOR VARYING ELECTRICAL RESISTANCE. Walter G. Hudson, New York. App. filed Feb. 19, 1914; issued July 11, 1916. A filament for Audion receivers in which a tungsten loop is wrapped for a portion of its length with tantalum so as to combine the durability of the former with the high electron emission of the latter.

1,190,869. QUENCH SPARK DISCHARGER; Lee de Forest, New York. App. filed April 24, 1915; issued July 11, 1916. Enclosed gap having series of sparking surfaces in carbon tetrachloride vapor.

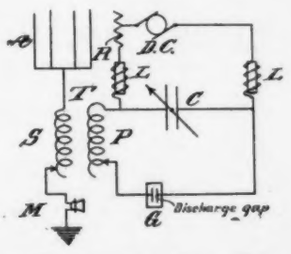


Fig. 2—Chaffee connections for wireless telephony. No. 1,189,791.

1,190,973. TRANSMITTING MEANS FOR WIRELESS TELEGRAPHY; Chester M. Agner, Sacramento, Cal. App. filed June 8, 1914; issued July 11, 1916. Morse signaling mechanism whereby unskilled operators may send distress or other calls. Has interchangeable characters.

Recent Radio Patents

Notes and Comments on United States Patents on Radio Signaling and allied topics issued during July 1916.

1,192,126. WIRELESS TELEGRAPH TRANSMITTER; Archibald Shaw, Randwick, New South Wales. App. filed June 29, 1912; issued July 25, 1916. Transmitting apparatus operating with shock excitation produced by use of a cone-and-plate gap having a high pressure needle-blast of gas applied through the cone electrode.

DISCUSSION

Probably the most interesting patent of the month is that issued to Chaffee, No. 1,189,791, shown in Figs. 1 and 3. Fig. 1 shows a preferred form of construction for the spark gap. It will be noted that there are two electrodes *E*, *E*, having plane parallel surfaces slightly and adjustably separated and formed of dissimilar metals such as aluminum and copper. These are contained within a closed chamber *n* which is supplied with hydrogen or a hydrocarbon gas through the inlet and outlet tubes *i* and *o*. The mechanical arrangement whereby the electrodes are carried by the adjustable supports *t*, *t'* can be seen clearly from the drawing. The two electrode holders have cooling flanges *D*, *D'*, and are insulated from each other by means of the dividing block of hard rubber *b*. Connection is made through binding posts at the top, as shown at *P*.

Fig. 2 shows one scheme of connections which has been found suitable for wireless telephony. *D.C.* represents a continuous current dynamo of from 400 to 500 volts, whose output is led through the variable resistance *R* and the choke coils *L*, *L*, to the terminals of the variable condenser *C*. Across the condenser are connected, in series, the primary coil *P* and the discharge gap *G*; this has the effect of placing the voltage of the generator directly across the spark-gap. Coupled to the coil *P* is the secondary *S*; its terminals are connected to the antenna *A* and, through the microphone *M*, to ground. It is customary to connect the aluminum electrode to the negative side of the line, and to operate with a spark gap of only about one-tenth millimeter.

In generating oscillations in the antenna circuit, the currents in the gap are practically unidirectional pulses. That is to say, almost perfect quenching is had. The successive pulses are timed to occur at a frequency which is some sub-multiple of the antenna oscillation-frequency, and the circuits are adjusted so that the phase of the recurring pulses is just right to maintain the aerial in vibration. If the impulse frequency is one-half the wave-frequency, the antenna is excited at every second swing; if the impulse frequency is only one-tenth that of the aerial, energy is applied only at each tenth swing. In any case the radiation is practically continuous, for the discharge frequency is always high as compared to audibility and is in correct phase relation.

The two points of fractional discharge frequency and truly continuous emission of waves are highly important. Because of the former, it becomes possible to generate exceedingly short waves. The patentee states that several amperes of continuous and practically undamped radio frequency current of 15,000,000 cycles per second have been produced. The continuity is the result of the regular phase of impulse, since if the discharges did not occur at the proper instants they would destroy instead of augment the oscillations already existing in the aenna. Short continuous waves will doubtless become extremely useful in the practice of radio-telegraphy, since by their use the selective power of beats receivers (heterodynes) becomes extraordinarily effective. The Chaffee gap arrangement may become a strong competitor of the various vacuum tube oscillators for such transmission.

The construction of Dr. Hudson's composite filament for vacuum receivers of the Audion and Fleming Valve type is shown by Fig. 3, which is reproduced from his patent 1,190,412, noted above. One of the greatest handicaps to the use of the electronic receivers seems to have been overcome by this simple device, for the life of the filaments is said to be greatly increased by its use. When tantalum is used alone for an Audion filament, good sensitiveness is secured at fairly low filament temperatures; nevertheless, the heating current must be sufficiently large that bright incandescence is had. After comparatively short use, the filament starts to pit; once this begins, its disintegration is quite rapid, for the portion which is thinned out by the erosion reaches a higher temperature than the neighboring parts and thus wears away all the faster. If tungsten is used alone, the bulb seems to require a much higher filament temperature in order to get the same sensitiveness; thus the life of the lamp is shortened. By the composite filament shown in the illustration Dr. Hudson divides to some extent the heating and electron-emitting function of the glower. The strong electronic emission of tantalum is secured at the lower temperature range which tungsten can stand almost indefinitely without danger of burning out. The practical effect seems to have been to increase the life of the lamps some four or five times.

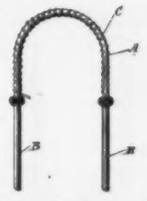


Fig. 3—Dr. Hudson's composite filament for vacuum receivers. No. 1,190,412.

Dr. de Forest's carbon-tetrachloride spark gap is shown in Fig. 4, which is taken from his patent 1,190,869. The small discharge electrodes 3 are arranged in series, upon insulated rods 7, which pass through bushings 9. Connection is made by way of the rods 4 insulated from the ribbed case 1 by tubes 6. At the bottom of the casing rests a quantity of carbon tetrachloride 10; its vapor passes over and through the spark gaps and is condensed upon the sides of the casing, which is cooled by air from the fan 12. The effect of the vapor is to cool the gaps very strongly and to prevent almost entirely the formation of any arc. This assists in the quenching action which is desirable in many types of wireless telegraphy transmitter. Carbon tetrachloride has been used in fire extinguishers and in lightning arresters for the purpose of suppressing combustion; in this device it is applied to a spark-gap for radio-telegraphy. Such an instrument should prove useful in place of the usual quenched gap, since its sparking surfaces are kept entirely free from oxidation and should require practically no care from the operators in charge of the wireless outfit.

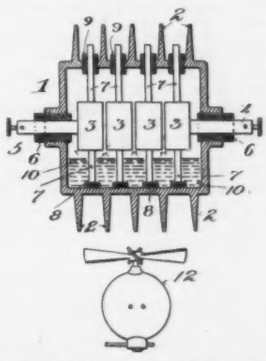


Fig. 4—Dr. de Forest's carbon-tetrachloride spark-gap. No. 1,190,869.

Efficient Employees as an Element in Costs—Experience in Heating Hous

1,193,508. TROLLEY-WIRE APPARATUS; G. Budrick, Allentown, Pa. App. filed April 6, 1912. Simple and durable strain plate.

1,193,513. BINDING-POST. W. A. Chryst, Dayton, Ohio. App. filed Jan. 6, 1913. Will support a plurality of terminal clips or wires.

1,193,519. LIGHTING-FIXTURE; D. Crownfield, Cambridge, Mass. App. filed June 9, 1915. Two-colored signal light for hospital use.

1,193,520. LIGHTING-FIXTURE; D. Crownfield, Cambridge, Mass. App. filed June 17, 1915. For operating rooms in hospitals.

1,193,521. WIRE-HANGER; E. R. Cunningham, Portland, Maine. App. filed Aug. 23, 1915. For the curves of catenary trolleys.

1,193,534. FOUNTAIN-PEN FLASH-LIGHT; J. Friedman and J. L. Friedman, New York, N. Y. Filed Oct. 5, 1915. Lamp disposed under pen point.

1,193,537. DYNAMO IN COMBINATION WITH AUTOMATIC SWITCH; E. Girardeau, Paris, France. App. filed March 11, 1916. Uses field produced by generator armature for actuating the automatic cut-out-battery charging.

1,193,539. SIGNALING DEVICE FOR AUTOMOBILES; De W. H. Gray, Fresno, Cal. App. filed March 27, 1916. Extensible signal lamp.

1,193,548. LIGHTING SYSTEM FOR MOVING VEHICLES; G. Honold, Stuttgart, Ger. App. filed June 7, 1915. Switch for connecting generator alone to lamps without including automatic voltage switch.

1,193,602. INSULATOR-SUPPORTING FIXTURE; C. L. Peirce, Jr., Pittsburgh, Pa. App. filed April 6, 1916. Sheet metal construction.

1,193,606. SNAP-SWITCH; C. D. Platt, Bridgeport, Conn. App. filed Sept. 10, 1915. Simplified form of two-button push switch.

1,193,621. APPARATUS FOR INDICATING AND LOCATING DEFECTS IN THE IGNITION, VALVE AND CARBURETER SYSTEMS OF INTERNAL-COMBUSTION ENGINES; E. H. Scott, Malvern, near Melbourn, Vic., Australia. App. filed Nov. 18, 1914. For automatically determining whether fault is in the ignition system, valves or carbureter.

1,193,622. CIRCUIT-BREAKER; W. M. Scott, Tredyferin Township, Chester Co., Pa. App. filed Nov. 28, 1914. Toggle construction enables easy operation of a large heavy switch.

1,193,633. ELECTRIC FUMING OR DISTILLING FURNACE AND CONDENSER THEREFOR; J. Thomson, New York, N. Y. App. filed Oct. 2, 1915. Refining impure metal and producing coalesce metal.

1,193,641. ELECTRICAL RECTIFIER; C. M. Wall, Toledo, Ohio. App. filed Dec. 2, 1915. Vibrator and booster.

1,193,646. FUSE-RECEPTACLE LOCK; G. Wesley, St. Paul, Minn. App. filed Sept. 18, 1915. Fuse plugs protected by a seal.

1,193,656. BURGLAR AND HOLDUP ALARM; G. E. Yeager, Chicago, Ill. App. filed Sept. 25, 1915. Cannot be tampered with —Fires successive shots.

1,193,660. ELECTRIC SWITCH; T. E. Barnum, Milwaukee, Wis. App. filed Nov. 21, 1908. Electrically magnetically operated.

1,193,678. ELECTROMAGNET; F. F. Fowle, Chicago, Ill. App. filed Dec. 15, 1910. Has an enclosing annular shell the edge of which constitutes one pole face.

1,193,694. ELECTRIC SWITCH; E. H. Jacobs, Schenectady, N. Y. App. filed March 9, 1911. Oil switch in which contact is given a straight line motion.

1,193,695. ELECTRIC SWITCH; E. H. Jacobs, Schenectady, N. Y. App. filed April 26, 1912. Oil switch with straight line motion and parts protected from breakdown.

1,193,698. IGNITION-SWITCH; W. Kaisling, Chicago, Ill. App. filed April 10, 1913. Combination lighting and ignition switch with lock.

1,193,705. CIRCUIT-CLOSER; W. G. Lynch, Roanoke, N. C. App. filed March 10, 1915. Fuse holds wedging contact arm away from parallel conductors.

1,193,718. INTERLOCK; G. B. Reisbach, Milwaukee, Wis. App. filed May 13, 1911. Includes interconnected oscillatable shafts.

1,193,735. ROTARY EXHIBITOR; C. S. Sutter, Philadelphia, Pa. App. filed May 13, 1915. Used by oculists for testing eyesight.

1,193,741. METHOD OF PREVENTING DISINTEGRATION OF ANODES; G. D. Van Arsdale, New York, N. Y. Electricalizes copper solutions in the presence at the anode of ferros sulphate and sulphur dioxide.

Record of Electrical Patents

Notes on United States Patents issued August 8, 1916, prepared by Mitchell & Allyn, 41 Park Row, New York.

1,193,764. DRY CELL; D. Conlan, Jr., Brooklyn, N. Y. App. filed Nov. 16, 1915. Carries a strip for connection with adjoining cell and is concealed in jacket of cell when not in use.

1,193,773. MAGNETIC DETECTOR APPARATUS FOR RAILWAYS; A. H. Fox and A. W. Lenderoth, Stapleton, N. Y. App. filed Aug. 8, 1912. Involves magnetic communication between the vehicle and the roadway.

1,193,778. RECEIVING APPARATUS FOR RADIO TRANSMISSION SYSTEMS; A. H. Grebe, Richmond Hill, N. Y. App. filed Nov. 2, 1914. Sounds amplified to be heard at a distance from the apparatus.

1,193,783. ART OF REDUCING METAL ORES AND FUSING OTHER MATERIALS; C. B. Hillhouse, New York, N. Y. App. filed Nov. 25, 1912. Passes finely divided ore axially through an electric arc area.

1,193,786. ELECTROLYTIC APPARATUS FOR THE PRODUCTION OF LIQUOR FOR BLEACHING AND OTHER PURPOSES; A. Holliday, Wimbledon, London, Eng. App. filed Dec. 22. 1915. Electrodes can be separately removed from the frame.

1,193,793. ELECTROMAGNET; R. C. Jones and V. St. C. Monteith, Hagerstown, Md. App. filed Oct. 11, 1912. For operating the register for an ice chute.

1,193,798. CATALYZER APPARATUS FOR OXIDIZING AMMONIA; W. S. Landis, New York, N. Y. App. filed Jan. 27, 1916. For producing nitrous gases.

1,193,799. PLATINUM CATALYZER; W. S. Landis, New York, N. Y. App. filed Feb. 20, 1915.

1,193,800. CATALYZER FOR OXIDIZING AMMONIA; W. S. Landis, New York, N. Y. App. filed Feb. 20, 1915.

1,193,807. ELECTRIC-TELEGRAPH RECEIVING APPARATUS OF THE SELECTIVE TYPE; W. J. Lyons, Doblin, Ireland. App. filed June 26, 1914. Single apparatus with a single movable arm.

1,193,821. AUTOMOBILE SIGNAL; H. B. Richards and R. Solomon, Alexandria, Va. App. filed March 10, 1916. Push button controlled.

1,193,835. DESPATCHER'S TELEPHONE SYSTEM; C. A. Simpson, Chicago, Ill. App. filed July 30, 1910. Special selective apparatus and locking circuit.

1,193,841. PROJECTING ARC LAMP; A. D. Standeford, Kansas City, Mo. App. filed Feb. 3, 1913. Novel carbon clamp mounting and guides.

1,193,848. LIGHTNING ARRESTER; G. W. Van Horn, Tulsa, Okla. App. filed July 21, 1915. For oil tanks.

1,193,882. ELECTRIC ARC FURNACE; E. Edwin, Christiania, Norway. App. filed May 13, 1915. Of the tube type.

1,193,890. TROLLEY CATCHER AND RETRIEVER; C. E. Gierding, New Haven, Conn. App. filed Jan. 11, 1915. Holding dogs are positively moved by cam means.

1,193,897. DYNAMO-ELECTRIC MACHINERY; R. A. Holbech, Ellesmere, Eng. App. filed July 29, 1911. Means for cooling high-speed alternators.

1,193,917. MOTOR-CONTROL SYSTEM; H. V. Nys, West Allis, Wis. App. filed Oct. 4, 1911. Series field winding of the driven compound generator can be cut into and out of circuit at will.

1,193,926. ELECTRIC SIGNALING DEVICE; R. R. Root, Cleveland, Ohio. App. filed Oct. 23, 1915. Electric Horn and special armature mounting.

1,193,966. SOCKET SHELL; L. W. Anderson, Waterbury, Conn. App. filed March 3, 1915. Shell held to cap by screw ring.

1,193,976. ILLUMINATED LEVEL; R. Bennett and A. E. Blanchard, Presque Isle, Maine. App. filed Sept. 22, 1914. Improved construction with control switch.

1,193,979. GALVANOMETER; A. Blondel, Paris, France. App. filed April 9, 1913. Has a narrow air gap and an externally adjustable extending device.

1,193,989. ELECTRODE FOR WELDING, BLAZING, SOLDERING, OR THE LIKE; C. L. Cadle, Rochester, N. Y. App. filed Feb. 25, 1915. Uses main current from an electric railway for rail bonding purposes.

1,193,999. METHOD OF AND APPARATUS FOR TRANSFORMING MOTION INTO ELECTRICAL WAVES OR IMPULSES; T. B. Dixon, New York, N. Y. App. filed July 9, 1915. Greater efficiency in utilization of light for production of current fluctuations.

1,194,000. METHOD OF PURIFYING SEWAGE AND THE LIKE; D. T. Dobyns and J. K. Elderkin, Jr., Newark, N. J. App. filed Dec. 22, 1915. Subjects solid content to electrochemical treatment in the presence of a germicide.

1,194,018. SOUNDING DEVICE FOR DECOYS; F. V. Hartner, Toledo, Ohio. App. filed March 18, 1916. Magnet for vibrating a reed within body of decoy.

1,194,071. METHOD OF EXCITING X-RAY TUBES; C. E. Rohrer, Elkhart, Ind. App. filed Dec. 16, 1913. Utilizes high potential a.c. by rectifying selective cycles.

1,194,084. ELECTRICAL MEASURING INSTRUMENT; B. H. Smith, Turtle Creek, Pa. App. filed Nov. 28, 1913. Graphic meter with mechanically controlled contacts.

1,194,066. SYSTEM OF WIRELESS COMMUNICATION; J. A. Proctor, Revere, Mass. App. filed July 3, 1912. Sender producees a single sharp blow. (48 claims.)

1,194,090. ELECTRICAL WINDING; C. P. Steinmetz, Schenectady, N. Y. App. filed Nov. 27, 1914. Transformer coils arranged to prevent building up of abnormal frequencies.

1,194,099. ELECTRIC RAILWAY VEHICLE; K. Von Kando, Vado, Ligure, Italy. App. filed Dec. 9, 1914. Aims to prevent play of the immediate crank shaft.

1,194,103. ALTERNATING-CURRENT MOTOR; A. F. Welch, Fort Wayne, Ind. App. filed Nov. 30, 1915. Starts as repulsion and runs as induction motor.

1,194,115. PERCOLATING APPARATUS; C. Aalborg, Wilkinsburg, Pa. App. filed Feb. 17, 1913. Has a removable heating device.

1,194,116. RAILWAY SIGNALING; H. D. Abernethy, Cleveland, Ohio. App. filed June 24, 1915. For single track stretches.

1,194,122. CONNECTING PLUG; H. P. Ball, Spring socket clip construction.

1,194,122. CONNECTING PLUG; H. P. Ball, New York, N. Y. App. filed Jan. 6, 1915. Spring socket clip construction.

1,194,125. RHEOSTAT; H. F. Bethune, Wilkinsburg, Pa. App. filed March 1, 1911. For operation by electromagnet.

1,194,129. WATTMETER; W. M. Bradshaw and A. W. Copley, Wilkinsburg, Pa. App. filed March 9, 1912. High degree of accuracy in operation over wide range.

1,194,132. TIME-LIMIT RELAY; H. W. Brown, Ithaca, N. Y. App. filed June 18, 1913. Insures positive operation of protective apparatus.

1,194,134. SWITCH; M. D. Brown, Waterloo, Ia. App. filed Dec. 21, 1915. For pocket flashlights.

1,194,137. ELECTRIC PLUG; G. H. Buckley, Indianapolis, Ind. App. filed Dec. 26, 1914. Made of longitudinally slidable sections.

1,194,138. ROTARY CONVERTER; J. L. Burnham, Schenectady, N. Y. App. filed Feb. 11, 1915. Dynamo electric machine acting as reactance in series with mains supplying the converter.

1,194,140. VACUUM-TYPE CONVERTER; L. W. Chubb, Edgewood Park, Pa. App. filed Oct. 7, 1915. Temperature of arc space and cathode maintained at desired figure.

1,194,142. SYSTEM FOR TELEGRAPHIC AND TELEPHONIC COMMUNICATIONS; J. H. Claus, W. Philadelphia, Pa. App. filed August 29, 1913. High speed communication employing a "cable" or "land wire."

1,194,143. STARTING ELECTRODE FOR VAPOR ELECTRIC DEVICES; F. Conrad, Swissvale, Pa. App. filed Jan. 30, 1914. Improved sealing means and bearings for operating parts.

1,194,154. APPARATUS FOR PRODUCING ELECTRICAL OSCILLATIONS; M. Eastham, Cambridge, Mass. App. filed Dec. 28, 1914. Produced by impact excitation.

1,194,160. CAM RECTIFIER; C. Le G. Fortesque, Pittsburgh, Pa. App. filed March 30. 1914. Includes a forked arm having rollers engaging a cam.

1,194,165. ENERGY SUPPLY SYSTEM; W. H. Fry, Great Barrington, Mass. App. filed March 17, 1915. Demand of the intermittent devices plus heating devices remains substantially constant.

1,194,168. LUMINOUS RADIATOR; A. J. Geiger, Pittsburgh, Pa. App. filed Jan. 15, 1913. Constructed from two sheet steel punchings.